Unbundling Ownership and Control*

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Abstract

We study control contests under asymmetric information. Using a mechanism design approach, we fully characterize the optimal control contest mechanism. The optimal mechanism requires increasing the number of shares owned by the incumbent insider if he remains in control, while giving him a golden parachute that includes both shares and cash if he is deposed. The model underscores a novel explanation for the prevalence and persistence of the separation of ownership from control: efficiency in control contests is more easily achieved when ownership of cash flow rights is not concentrated in the hands of insiders.

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1 Introduction

We study control contests in the presence of asymmetric information about managerial talent. Our goal is to help explain how efficiency in control contests affects, and is affected by, the relationship between ownership of cash-flow rights and control rights.[1] To do so, we consider a model in which managerial talent is the only determinant of the value of a closely-held firm. Examples of closely-held firms include entrepreneurial firms, venture-capital-backed firms, and firms owned by a few private investors.

In this setting, efficiency requires control rights to be assigned to the shareholder with the highest managerial ability or, equivalently, to the shareholder who is most able to appoint and monitor managers. To achieve this, a control contest must be incentive compatible, providing shareholders (who are potential managers) with incentives to truthfully reveal their private information. As a result of these incentives, shareholders who participate in a control contest receive informational rents. This may generate extra costs for agents who buy shares and extra benefits for agents who sell them. Consequently, it may preclude efficient allocations of control.

We show that the degree of separation between cash-flow rights and control rights affects the extent of informational rents. The degree of separation also affects shareholders' incentives to participate in the control contest: shareholders who initially own more shares need a higher expected payoff, in the control contest, to be willing to participate. Given the total expected gain from restructuring, there is a trade-off between providing informational rents for all participating shareholders to induce truth-telling and ensuring shareholders'

[1] Throughout this paper, "ownership" refers to cash-flow rights.

incentives to participate. We identify the degree of separation between cash-flow rights and control rights that best economizes on this trade-off, thereby facilitating efficient transfers of control.

Our analysis yields two main contributions: one applied and one theoretical. Our main contribution to the applied corporate finance literature is the finding that efficiency in control contests generally requires the unbundling of ownership from control. That is, the winner of a control contest must not acquire 100% of the cash-flow rights. An important corollary is that shareholders who lose control must receive compensation paid in shares (e.g. stock-based "golden parachutes").

Our main theoretical contribution is the introduction and characterization of the optimal mechanism that implements efficient transfers of control whenever possible. Under this mechanism, every shareholder participates and truthfully reports his ability; control is then allocated to the shareholder with the highest ability. To induce truthful revelation and voluntary participation, the mechanism determines a rule that allocates ownership shares conditional on shareholders' reports. Conditional on using this optimal share rule, we show that efficient control restructuring is easier to achieve when the controlling shareholder initially owns fewer shares.

We show that the optimal share rule typically maintains some separation of ownership from control. To better understand the forces driving the optimal mechanism, consider the effects of reducing the share allocated to the "winner" of control away from unity. This has two primary effects. First, it reduces the number of shares that the winner must buy upon acquiring control; this reduces the informational rents required by incentive compatibility.[2]

[2] When winning shares are less than one, expected rents are strictly smaller than under bilateral exchange

Second, it reduces shareholders' expected gains from participating in the control contest; this effect makes it more difficult to induce all shareholders to participate. Hence, reducing winning shares away from full ownership affects the possibility of efficient transfers of control in both positive and negative ways. The optimal winning shares trade off these two effects.

For simplicity, we derive our results in a model in which there is only one insider (the incumbent controlling shareholder) and one outsider (a control contestant). The optimal winning shares for insiders and outsiders are qualitatively distinct. For insiders, the two effects described in the previous paragraph are at play and their balance determines the optimal winning share. For outsiders, reducing winning shares is actually unambiguously beneficial for control restructuring. Hence, the optimal share rule sets the outsider's winning share at the lowest possible level and the corresponding insider's losing share—his "golden parachute"—at the highest possible level.

The initial ownership structure affects the possibility of efficient restructuring as well. Intuitively, shareholders that initially own large shares must give up more to participate in restructuring, making them more reluctant to do so voluntarily. A decrease in the insider's initial share therefore introduces a trade-off. On one hand, it lowers the insider's status-quo payoff (i.e. it slacks his participation constraint), making him more willing to participate in the control contest. On the other hand, it makes the outsider less willing to participate,

(Myerson and Satterthwaite, 1983) or partnership dissolution (Cramton, Gibbons and Klemperer, 1987). In one striking case, when control is traded but shares are not traded, the mechanism is incentive compatible but there are no informational rents. In another case, when a shareholder's "losing" share exceeds his winning share, informational rents are negative, in the sense that share trading yields a budget surplus for a hypothetical mechanism designer.

because now the outsider needs to give up more shares. We nevertheless show that, under the optimal mechanism, insiders' status-quo payoffs per share are higher than outsiders' status-quo payoffs. Hence, our model predicts that a lower insider's initial ownership share slacks *aggregate* participation constraints, facilitating transfers of control. This finding is supported by recent empirical evidence. In a sample of closely-held companies that recapitalized towards dual-class share structures, Bauguess, Slovin and Sushka (2012) find that a reduction in insider ownership of cash flow rights (keeping control rights constant) is associated with a substantial increase in the likelihood of takeovers. To our knowledge, ours is the first model to rationalize this relationship between the separation of control from ownership and the likelihood of takeover.

The separation of ownership and control is a much discussed topic in a well established and influential literature. Demsetz (1983, p. 385-86) emphasizes that wealth constraints may prevent the firm from achieving proper scale absent some separation of ownership from control. Fama (1980) and Fama and Jensen (1983) argue that efficient risk-bearing naturally allocates cash-flow rights away from managers. Jensen and Meckling (1976) study the implications of the separation of ownership and control for agency conflicts. Instead of wealth constraints, risk aversion, or moral hazard problems, our analysis focuses on the consequences of asymmetric information and participation requirements.

More generally, the idea that some degree of separation between cash-flow rights and control rights in entrepreneurial firms might be optimal is well-known in the financial contracting literature (e.g. Aghion and Bolton, 1992; Dewatripont and Tirole, 1994). Such theories are supported by the evidence in Kaplan and Strömberg (2003), who show that venture capitalists and entrepreneurs enter into contracts that typically separate cash flow rights from voting rights. Our model differs from that line of research due to our focus on asymmetric information rather than on moral hazard issues.

Our results relate directly to the literature on changes in corporate control and ownership (takeovers, asset sales, bankruptcy reorganizations, public and private offerings, etc.). This literature usually focuses on specific buying and selling mechanisms. Such mechanisms are natural and realistic in a number of contexts. For example, conditional take-it-or-leave-it offers are used to model unsolicited tender offers when ownership is diffuse (e.g. Grossman and Hart, 1980) and in both one- and two-sided asymmetric information takeovers involving two large players (e.g. Berkovitch and Narayanan, 1990; Eckbo, Giammarino and Heinkel, 1990). Bidding contests in takeovers have also been modeled as (typically English) auctions (e.g. Baron, 1983; Burkart, 1995; Fishman, 1988; Singh, 1998). Auctions followed by private negotiations between the seller and a selected buyer appear to be a good approximation for real-world asset sales (Hege et al., 2009). Unlike this literature, we use a mechanism design approach to study a more general environment.[3]

The technical features of our approach relate closely to those in the literature motivated by Cramton, Gibbons and Klemperer (1987), who apply mechanism design techniques to study efficient bargaining over the sale of assets jointly owned by partners in the presence of asymmetric information (see also McAfee, 1992; Fieseler, Kittsteiner and Moldovanu, 2003; Jehiel and Pauzner, 2006; Ornelas and Turner, 2007). Our result that efficient control restructuring is easier when the controlling shareholder initially owns fewer shares contrasts with models where agents' values are independent (e.g. Cramton, Gibbons and Klemperer, 1987) or interdependent but not common (Fieseler, Kittsteiner and Moldovanu, 2003), where

[3] See Mathews (2007) for a model in which the optimal takeover mechanism is also derived endogenously.

efficient bargaining is most likely for equal-share endowments. In those standard cases, efficient bargaining implicitly requires ex post bundling of ownership and control, so mechanism designers lack the flexibility seen in our setting.

As in the models of this "partnership dissolution" literature, we largely abstract from problems of incentives and of team coordination emphasized in the broader literature on partnerships (e.g. Holmström, 1982). Our analysis also relates to a recent paper by Segal and Whinston (2011),[4] who study the initial allocations that permit efficient bargaining in more general environments. To help communicate the intuition of how our model works, we discuss in detail how our approach and results compare with those of this literature in Section 4.

Before that, we introduce the basic model (Section 2) and study the conditions under which efficient restructuring is possible (Section 3). We conclude in Section 5 with a brief discussion of the empirical content of our model and of the limitations of our analysis.

2 The Basic Model

Consider a closely-held, all-equity firm that is initially controlled by a single shareholder, the insider, who holds a fraction $r \in [0,1]$ of the shares of this firm.[5] There is another shareholder, the outsider, who owns $1-r$ of the cash flow rights. The insider has full control over the operations of the firm, in the sense that he makes all decisions about how corporate resources are allocated without having to consult with the outsider. For exogenous reasons,

[4] See also Segal and Whinston (2012).

[5] Capital structure considerations play no important role in our analysis. Nothing changes qualitatively if the firm is initially levered. We choose this approach for simplicity.

the two shareholders need to restructure control of the firm to achieve efficiency. This could be because the initial allocation was set inefficiently or, perhaps more plausibly, because conditions external to the firm changed in ways that turned the initial allocation inefficient. The insider and the outsider are indifferent to risk and there are no wealth constraints. The outsider is the only possible suitable replacement for the insider.[6]

2.1 Technology and information

Shareholder $i's$ ability in running the firm is a_i, where $i = 1$ indicates the insider and $i = 2$ the outsider. We treat a_i as a measure of managerial talent, but other interpretations are possible. For example, a_i could be a measure of shareholder i's ability to identify the right people who will actually run the business. Managerial talent is private information. Thus, shareholder i knows his own ability a_i, but shareholder $j \neq i$ knows only the distribution of a_i. Abilities are independently distributed according to a differentiable cumulative distribution function $F(a)$ on $[\underline{a}, \overline{a}]$, with mean μ.[7] Profit, while stochastic, is a linear function of managerial ability: $\Pi(a_i, \varepsilon) = a_i + \varepsilon$, with $E(\varepsilon \mid a_i) = 0$ and $Var(\varepsilon \mid a_i) > 0$, so that managerial ability is not ex post verifiable.[8] Thus, under the initial control structure, the

[6]Our model allows for the possibility that the outsider is not a shareholder in the proper sense, i.e. we could have $r = 1$. Thus, *shareholder* in this paper should be understood as someone who is an important player in a restructuring decision (such as a candidate for the CEO post), even if he holds no shares.

[7]The main results of our model do not depend on the distribution of abilities of both shareholders being the same, carrying over to the case where $F_1 \neq F_2$, as for example in Ornelas and Turner (2007). This case may be relevant. For example, if stock prices reveal information about the quality of the incumbent manager, one might have a more precise signal of a_1 than of a_2.

[8]We also assume that the support of ε is unbounded and that $\Pi(a_i, \varepsilon)$ satisfies the Monotone Likelihood Ratio Property. This rules out contracts that impose near-infinite fines to shareholders who misrepresent

insider expects profit to be $\pi = a_1$, while the outsider expects profit μ. If upon restructuring the outsider becomes the manager, the firm's expected profit becomes $\pi = a_2$. For brevity, when referring to expected profit where the only source of uncertainty is ε, we henceforth drop the "expected" modifier to profit.

This specification allows us to study in a relatively simple way the problem of efficient transfers of control in a two-sided private information environment where both the insider and the outsider have better information about their abilities as managers. Our setup shares many features with the typical models of partnership dissolution, but with two key distinctions. First, as in Ornelas and Turner (2007), the value of shares is common across shareholders and is determined by the manager's type. Second, we allow for ex post share allocations that do not require full dissolution or, rather, that permit unbundling ownership from control. Such allocations are first-best provided they are feasible and do not introduce other costs. To capture this idea, we introduce a parameter $\underline{s} \in [0, 1]$ that indicates the minimum share requirement for the manager who wins the control contest. In the partnership dissolution literature, $\underline{s} = 1$, and thus, the question about which ex post share structure should be chosen is moot. Allowing for $\underline{s} < 1$ expands the set of feasible ex post share rules, of which dissolution is just one special case. We show that this generalization of the canonical model of partnership dissolution changes the nature of the problem significantly.

But why would $\underline{s}$ be different from zero? One reason is that insiders may have incentives to divert company profits, inefficiently, for private gain. Thus, a minimum managerial ownership may be required to prevent agency problems. A minimum managerial ownership share may also be required for reasons other than agency costs. For instance, $\underline{s}$ could be

their abilities.

affected by legal or institutional forces that govern the required minimum share necessary for acquiring control. Since the reasons behind $\underline{s}$ are not central for our analysis, we take $\underline{s}$ as given.[9] For consistency, in what follows we also assume that the initial ownership allocation must satisfy the minimum share requirement, i.e. $r \geq \underline{s}$.

2.2 Rules and timing of the game

There is an initial, exogenous allocation of control and of ownership. Next, each shareholder learns his ability. They then write a binding bilateral contract to reallocate ownership and control between themselves. Under the rules of this contract, they implement a new allocation of shares and control rights. Finally, production takes place and the firm generates profit $\pi = a_j$, where j is the index of the shareholder that has control ex post.

If there were no private information, the first-best allocation could always be achieved, with control being assigned to the most talented shareholder regardless of the initial ownership and control structures. This is, in fact, a simple illustration of the Coase Theorem. The expected surplus from restructuring in this case would be the first best, $V^{fb} \equiv E(\tilde{a} - a_1)$, where $\tilde{a} \equiv \max\{a_1, a_2\}$ and $E[\cdot]$ represents the expectation over both a_1 and a_2. Clearly, the surplus from restructuring under asymmetric information must be (weakly) lower than V^{fb}.

[9] Parameter $\underline{s}$ can be endogeneized in different ways. A micro-foundation for $\underline{s}$ based on an explicit model of agency costs (Burkart, Gromb and Panunzi, 1998) can be found in previous working paper versions of this article.

2.3 Mechanisms for efficient allocation of ownership and control

Appealing to the revelation principle, we restrict attention to direct revelation mechanisms. Let bold variables represent vectors. Shareholders simultaneously report their types $a = \{a_1, a_2\}$ and the mechanism determines (1) the new control structure $c(\mathbf{a}) = \{c_1, c_2\}$, (2) the new ownership structure $s(\mathbf{a}) = \{s_1, s_2\}$, and (3) the net transfers paid to shareholders $t(\mathbf{a}) = \{t_1, t_2\}$. We consider that control is indivisible, so that $c_i \in \{0, 1\}$, where $c_i = 1$ indicates that shareholder i has control (so that $\pi = a_i$) and $c_i = 0$ indicates that he does not have control. We call $\langle c, s, t \rangle$ a restructuring mechanism, and we refer to the set of available restructuring mechanisms as the market for control.

A necessary condition for a mechanism to be ex post efficient is that it allocates control according to[10]

$$c_i = \begin{cases} 1 & \text{if } a_i = \tilde{a} \\ 0 & \text{if } a_i < \tilde{a}. \end{cases} \tag{1}$$

Any mechanism must, additionally, satisfy the minimum share requirement. Letting $s_i^{c_i}$ be the ownership share of shareholder i conditional on his control c_i, this requires

$$s_i^1 \geq \underline{s}. \tag{2}$$

Thus, our effective decision space is $D = \{(c_1, c_2), (s_1, s_2) | c_1 + c_2 = 1, c_i \in \{0, 1\}, s_1 + s_2 = 1 \text{ conditional on (2)}\}$. This space is not convex. For example, if $\underline{s} > \frac{1}{2}$, then there exist share allocations (e.g. equal-shares) that do not satisfy (2) regardless of the allocation of control.[11] As shown by Segal and Whinston (2011), such nonconvexities can make efficient bargaining

[10] The case where the two shareholders tie for highest type is a zero probability event and can be ignored.

[11] The space for the control allocation is also not convex. We discuss in the conclusion how relaxing this constraint could be useful for the analysis of second-best mechanisms.

impossible for any ex ante ownership in the decision space. Intuitively, a high value of $\underline{s}$ requires a high level of share trading when control is reassigned. High levels of share trading generate both high informational rents and extreme pivotal types of participants, who earn low gains from participating in the mechanism (Myerson and Satterthwaite, 1983).

Without loss of generality, we restrict attention to a special class of incentive compatible, ex post efficient direct mechanisms, which we call M-mechanisms.

Definition 1 *M-mechanisms are a family of mechanisms with the following characteristics:*

1. *Each shareholder pays a (positive or negative) up-front fee (k_1, k_2);*

2. *each shareholder announces his type (b_1, b_2);*

3. *the highest announced type gains control;*

4. *shares are allocated according to a pre-determined share rule: $(s_1^0, s_2^1) = (g, 1-g)$ if the outsider gains control, $(s_1^1, s_2^0) = (w, 1-w)$ if the insider retains control, with $1-g \geq \underline{s}$ and $w \geq \underline{s}$; and*

5. *the shareholder who does not get control receives a (positive or negative) ex post transfer $\tau_i = (w-g)b_j$, $j \neq i$.*[12]

The next lemma proves that focusing on M-mechanisms is without loss of generality. See the Appendix for the proof.

Lemma 1 *Any mechanism that is incentive compatible and ex post efficient is payoff-equivalent to an M-mechanism.*

[12] When referring to $\mathcal{M}$-mechanisms, we make a distinction between up-front fees k_i and ex post transfers τ_i. We omit the qualifier "ex post" when referring to τ_i when there is no ambiguity.

Four parameters characterize an M-mechanism, which we denote by $M(k_1, k_2, g, w)$. The insider's golden parachute g and his winning share w determine the ex post share allocation. We therefore call (g, w) the mechanism's share rule. Note that the net transfer to shareholder i satisfies $t_i = \tau_i - k_i$.

Separation of ownership from control takes two distinct forms. We say there is ex ante separation if the insider initially has less than full ownership of cash flow rights: $r < 1$. We say there is ex post separation if, after restructuring, the new manager in charge obtains less than full ownership of cash flow rights: $w < 1$ and $1 - g < 1$.

Any M-mechanism is incentive compatible—i.e. it is a Bayesian-Nash equilibrium for all types to willingly reveal their true abilities. To see this, suppose the insider expects the outsider to report his ability truthfully: $b_2 = a_2$. If the insider retains control, his utility (net of the initial fee, which is independent of outcomes) is wa_1. If the insider surrenders control, he obtains instead $ga_2 + (w - g)b_2 = wa_2$ (given truth-telling by the outsider). Because his payoff is proportional to w regardless of his bid, there is no reason for the insider to misreport his ability. If his bid is too high, he risks winning when his type is lower than his rival's, which reduces his payoff. If his bid is too low, he might not win when his type is higher than his rival's, again reducing his payoff. Similar reasoning applies to the outsider. Intuitively, mechanisms in this class achieve truth telling for the same reason that Vickrey-Clarke-Groves mechanisms (e.g. a second-price auction in a setting of independent private valuations) achieve truth telling. However, the more general M-mechanism permits a broader set of ex post share rules.

An M-mechanism implements efficient restructuring provided that all players prefer to participate—i.e., provided that the mechanism is individually rational—and that the budget balances. We say a mechanism is (ex ante) budget balanced if control and ownership allocations are in D and the mechanism additionally satisfies[13]

$$E\left[t_1\left(\mathbf{a}\right)+t_2\left(\mathbf{a}\right)\right]\leq 0. \tag{3}$$

To understand the intuition behind budget-balanced M-mechanisms, consider first what happens when $w > g$. Without transfer τ_1, the insider would have an incentive to exaggerate his ability to increase the probability of being given the higher "winning" share. To counter such incentives, an M-mechanism offers the departing insider the money value equivalent of the exact amount of shares he "loses," $w - g$. The same is offered to the outsider who does not become the new manager. The expected value of one share after restructuring is $E[\tilde{a}]$. Therefore, the mechanism expects to execute a money transfer of $(w-g)E[\tilde{a}]$ to the shareholder who is not assigned control. To satisfy budget balance, initial fees $k_1 + k_2$ must be sufficiently high to cover the transfer. Notice that the money deficit created by the mechanism is nil if $w = g$ and negative if $w < g$, in which case the initial fees $k_1 + k_2$ are negative.

To characterize individually rational participation, consider first the case of the insider. Under $M\left(k_1, k_2, g, w\right)$, he expects to obtain

$$\begin{aligned}\Pr(a_2 &\leq a_1)wa_1+\Pr(a_2>a_1)E\left[ga_2+(w-g)a_2 \mid a_2>a_1\right] \\ &= wE_2[\tilde{a}|a_1],\end{aligned}$$

where $E_i[\cdot]$ is the expectation over a_i. Since the insider obtains utility ra_1 if there is no

[13] The qualifier "ex ante" applies only to the transfers. When ex ante budget balance is satisfied, one can apply the "expected externality" techniques of d'Aspremont and Gérard-Varet (1979) to find ex post budget-balancing transfers.

restructuring, his expected net utility from participating in the mechanism is

$$U_1\left(r,w,k_1,a_1\right) = wE_2[\tilde{a}|a_1] - k_1 - ra_1. \tag{4}$$

A necessary and sufficient condition for all types $a_1 \in [0,1]$ to be willing to participate is that the worst-off type a_1^* has a non-negative net surplus: $U_1\left(r,w,k_1,a_1^*\right) \geq 0$. Minimizing (4) with respect to a_1, we find

$$a_1^*(w,r) = \min\left\{F^{-1}\left(\frac{r}{w}\right), \overline{a}\right\}. \tag{5}$$

Expression (5) defines the worst-off type of insider. To see the intuition, let $w > r$ and consider the special case where $g = 0$. Type $F^{-1}(\frac{r}{w})$ expects to be allocated w shares with probability $\frac{r}{w}$ and 0 shares otherwise, i.e. he expects to be neither a buyer nor a seller under the mechanism. In essence, this type is worst-off because he is least able to capitalize on his private information to earn rent. Recall that the transfers in an M-mechanism eliminates g from the insider's net utility. Hence, for general $g > 0$, the worst-off type of insider's utility is "as if" he expects to be neither a buyer nor a seller. When $\frac{r}{w} \geq 1$, a corner solution obtains, and the worst-off type of insider is the highest type.

Similarly, the net utility of the outsider is given by

$$U_2\left(r,g,k_2,a_2\right) = (1-g)E_2[\tilde{a}|a_2] - k_2 - (1-r)\mu. \tag{6}$$

Minimizing (6), it is clear that the worst-off type of outsider is instead $a_2^* = \underline{a}$. Since the outsider's ability does not affect his status quo payoff of μ per share, it follows that the lowest type $\underline{a}$ expects the lowest firm profit under the mechanism.

Noting that the individual utilities are the private gains from reallocating control and ownership minus up-front fees, it is convenient to isolate the private gain component by defining utility net of the up-front fees:

$$\hat{U}_i\left(r, w, a_i\right) = U_i\left(r, s_i^1, a_i\right) + k_i.$$

An M-mechanism that is budget balanced and individually rational exists if and only if the total private gains from restructuring, for worst-off types, exceed the expected transfers necessary to execute restructuring efficiently.

Lemma 2 *An M-mechanism that is (ex ante) budget balanced and individually rational exists if and only if*

$$\hat{U}_1\left(r, w, a_1^*(w,r)\right) + \hat{U}_2\left(r, g, \underline{a}\right) \geq (w-g)E[\tilde{a}]. \tag{7}$$

Proof. A necessary condition for participation by all types is

$$U_1\left(r, w, k_1, a_1^*\right) + U_2\left(r, g, k_2, a_2^*\right) \geq 0, \tag{8}$$

where $a_1^*(w,r) = \min\left\{F^{-1}\left(\frac{r}{w}\right), \overline{a}\right\}$ and $a_2^* = \underline{a}$ are the worst-off types. Substituting, expression (8) becomes equivalent to

$$\hat{U}_1\left(r, w, a_1^*(w,r)\right) + \hat{U}_2\left(r, g, \underline{a}\right) \geq k_1 + k_2. \tag{9}$$

Ex ante budget balance implies that the up-front fees must be enough for paying for the expected ex post transfers:

$$k_1 + k_2 \geq E\left[\tau_1 + \tau_2\right]. \tag{10}$$

Since $E\left[\tau_1 + \tau_2\right] = (w-g)\,E[\tilde{a}]$ for an M-mechanism, the necessity part is proven.

Sufficiency follows from the observation that, if condition (7) holds, (k_1, k_2) can always be chosen such that the mechanism is budget balanced and individually rational. For example, to guarantee budget balance let

$$k_1 = (w - g) E[\tilde{a}] - k_2, \tag{11}$$

which implies that condition (7) can be rewritten as

$$\hat{U}_1 (r, w, a_1^*(w, r)) + \hat{U}_2 (r, g, \underline{a}) \geq k_1 + k_2, \tag{12}$$

which is equivalent to

$$U_1 (r, w, k_1, a_1^*(w, r)) + U_2 (r, g, k_2, \underline{a}) \geq 0. \tag{13}$$

If the above condition holds yet $U_1 (r, w, k_1, a_1^*(w, r)) < 0$, one can always decrease k_1 and increase k_2 so that both $U_1 (r, w, k_1, a_1^*(w, r)) \geq 0$ and $U_2 (r, g, k_2, \underline{a}) \geq 0$. ■

One immediate implication of Lemma 2 is that an efficient restructuring mechanism may not exist for a given share rule (g, w). For example, the full dissolution share rule $(0, 1)$ generates a negative net surplus from restructuring for any r. The reason is that full dissolution requires a relatively large amount of expected shares to change hands. Informational rents, which are proportional to the expected number of shares traded, are "too large" relative to the gains from trade in that case.[14]

3 Efficient Restructuring

While combining ownership and control ex post clearly creates problems for efficient restructuring, asymmetric information per se is not a problem for efficient restructuring. We make this clear in subsection 3.1, where we focus on a class of restructuring mechanisms that do

[14] See Ornelas and Turner (2007) for a detailed analysis of this specific case.

not involve transfers of shares or cash. But since these "control-only" mechanisms cannot always achieve efficient restructuring, in subsection 3.2 we turn our attention to general mechanisms that can deliver efficient restructuring in a broader range of circumstances by permitting exchange of control, shares and cash.

3.1 Control-only restructuring

Under the control-only restructuring mechanism, control may switch from the insider to the outsider, but no shares change hands. Though strikingly simple, provided each shareholder initially owns at least $\underline{s}$ shares, this is an M-mechanism and is therefore ex post efficient and (Bayesian-Nash) incentive compatible. Moreover, because both shareholders keep their shares ($g = w = r$), they benefit proportionally from the gains from reallocating control. Because this mechanism does not require any exchange of money, budget balance and individual rationality hold trivially. Hence, if there is no need for trading shares in a restructuring event, the control-only mechanism implements the first-best allocation.

Importantly, the control-only mechanism implies ex post separation of ownership from control: because $g = w = r$, the ex post manager will own either r or $1-r$ of the shares, and this mechanism leads to ex post separation with certainty if $r < 1$ (or with probability 0.5 if $r = 1$). Indeed, by specifying that no shares are traded, this mechanism yields an extreme form of unbundling ownership from control.

Now, when initial managerial ownership is very small or very large, the control-only mechanism will not be an M-mechanism because share trading will be required to achieve efficiency. For example, if $r = 1$ and $\underline{s} > 0$, control-only restructuring could result in a manager with zero ex post share ownership, which will not be optimal if the manager diverts profits for private benefit. Hence, when agency costs are present (or more generally when $\underline{s} > 0$ for any reason), ex ante separation of ownership from control is a necessary condition for control-only restructuring to be efficient. More generally, we have the following result.

Proposition 1 *Efficient restructuring is possible with the control-only mechanism if and only if* $r \in [\underline{s}, 1 - \underline{s}]$.

This result is illustrated in Figure 1. The range of parameters that allow control-only efficient restructuring corresponds to area I in the figure. It is maximal for $\underline{s} = 0$ and decreases monotonically with $\underline{s}$ until $\underline{s} = \frac{1}{2}$. For $\underline{s} > \frac{1}{2}$, control-only mechanisms cannot achieve efficient restructuring.

3.2 The optimal share rule

A control-only restructuring mechanism is sufficient for efficient restructuring when $r \in [\underline{s}, 1 - \underline{s}]$ but is not necessary. Furthermore, efficient restructuring may be possible in cases when $r \notin [\underline{s}, 1 - \underline{s}]$. We now identify a condition that is both necessary and sufficient for efficient restructuring.

Our goal is to characterize the general conditions under which efficient restructuring is possible. We do not impose any specific bargaining protocol for the negotiation process between the insider and the outsider. Instead, we only require that the outcome of such a process should be efficient whenever possible. To identify the conditions under which efficient restructuring is possible, it is useful to think of the mechanism as being implemented by a risk neutral "mechanism designer" who is contractually required to use only efficient restructuring

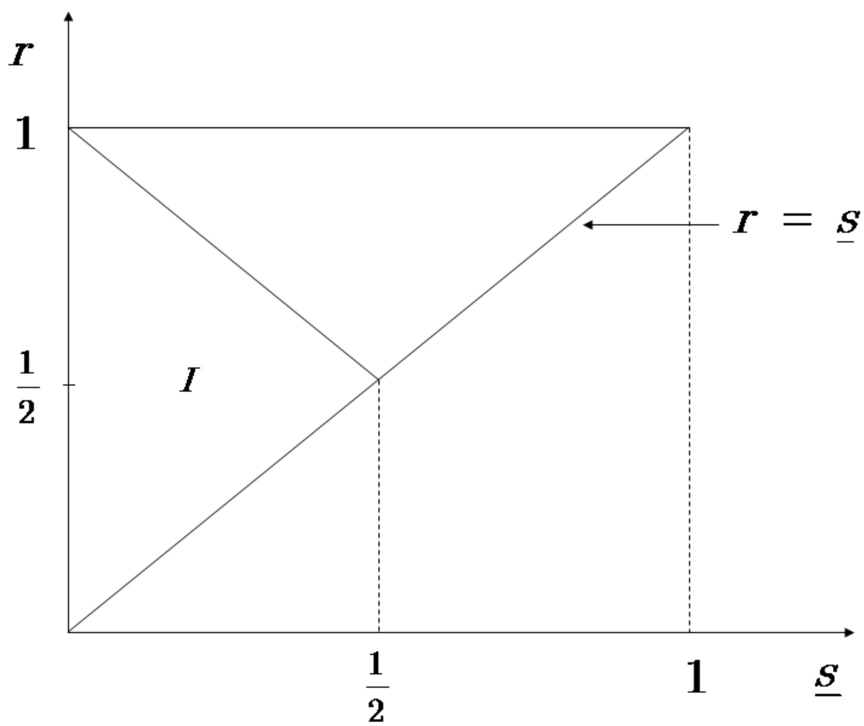

Figure 1: Control-Only Restructuring

mechanisms, but otherwise has the right to design a mechanism that maximizes his expected payoffs.[15]

Recalling Lemma 2, we define the net surplus of restructuring as

$$V(r, \underline{s}, g, w) = \hat{U}_1(r, w, a_1^*(r, w)) + \hat{U}_2(r, g, \underline{a}) - (w - g)E[\tilde{a}]. \tag{14}$$

If the net surplus for a given share rule is non-negative, then efficient restructuring is possible. Note that net surplus depends on the insider's golden parachute g and winning share w in non-trivial ways. The insider's golden parachute affects the payoff to the worst-off type of outsider directly. The insider's winning share affects the payoff to the worst-off type of insider directly and indirectly (through its effect on the identity of the worst-off type). Both g and w affect the level of the transfers in the mechanism.

Definition 2 *An optimal share rule* $[g(r, \underline{s}), w(r, \underline{s})]$ *satisfies*

$$[g(r, \underline{s}), w(r, \underline{s})] \in \arg\max_{(w,g)\in\mathbf{B}} V(r, \underline{s}, g, w),$$

where B is the set of all efficient share rules that satisfy budget balance. An optimal restructuring mechanism is an incentive compatible, individually rational, ex post efficient mechanism with ex post share rule $[g(r, \underline{s}), w(r, \underline{s})]$.

Defining the value function as $\widetilde{V}(r, \underline{s}) \equiv V(r, \underline{s}, g(r, \underline{s}), w(r, \underline{s}))$, we can show that the possibility of efficient restructuring with $[g(r, \underline{s}), w(r, \underline{s})]$ is necessary and sufficient for the possibility of efficient restructuring generally.

[15] Like the Walrasian auctioneer, the reliance on this hypothetical mechanism designer is just a convenient methodological artifice to help us study our problem.

Proposition 2 *The firm can be efficiently restructured if and only if it can be efficiently restructured with the optimal share rule.*

Proof. The proposition asserts that the firm can be efficiently restructured if and only if $\widetilde{V}(r, \underline{s}) \geq 0$. Sufficiency follows from Lemma 2 and the assumption that $r \geq \underline{s}$. To prove necessity, consider any other share rule (w', g') that also allows for efficient restructuring. By definition,

$$\widetilde{V}(r, \underline{s}) \geq V(r, \underline{s}, w', g'),$$

implying that restructuring must also be possible with $[w(r, \underline{s}), g(r, \underline{s})]$. ■

Proposition 2 shows that the optimal share rule is critical for understanding the limits and bounds of efficient restructuring. To fully understand what this result entails, we first fully characterize the optimal share rule. This characterization lays down the elements that allow us to subsequently study the general circumstances under which efficient restructuring is achievable.

Proposition 3 *The optimal share rule is unique and specifies*

1. $g(r, \underline{s}) = 1 - \underline{s}$;

2. $w(r, \underline{s})$ *such that* $E_2[\tilde{a}|a_1^*(r, w(r, \underline{s}))] \geq E[\tilde{a}]$, *with equality if* $w(r, \underline{s}) < 1$.

Proof. For simplicity, we ignore the non-binding constraints $w \geq 0$ and $g \leq 1$. The constrained-optimization problem maximizes

$$V(r, \underline{s}, g, w) + \lambda_1 [(1 - g) - \underline{s}] + \lambda_2(1 - w)$$

such that $\lambda_1\left[(1-g)-\underline{s}\right]=0$, $\lambda_1\geq 0, \lambda_2(1-w)=0$ and $\lambda_2\geq 0$. The first-order conditions satisfy

$$\begin{aligned}\frac{\partial V(r,\underline{s},g,w)}{\partial g} &= -E_1[\tilde{a}|\underline{a}]+E[\tilde{a}]-\lambda_1=0,\\ \frac{\partial V(r,\underline{s},g,w)}{\partial w} &= E_2[\tilde{a}|a_1^*(r,w)]-E[\tilde{a}]-\lambda_2=0.\end{aligned}$$

Clearly, V is concave in w and g, so these conditions identify a maximum. For the first condition, $-E_1[\tilde{a}|\underline{a}]+E[\tilde{a}]$ is a strictly positive constant function of g. Thus, $\lambda_1>0$ and $g=1-\underline{s}$. For the second condition, if $w<1$, then $\lambda_2=0$ and $E_2[\tilde{a}|a_1^*(r,w)]=E[\tilde{a}]$. If $w=1$, then the requirement $\lambda_2\geq 0$ implies $E_2[\tilde{a}|a_1^*(r,w)]\geq E[\tilde{a}]$. ■

Broadly speaking, the optimal share rule allocates (whenever possible) a relatively low number of winning shares to the outsider, but a relatively high number of (though not all) winning shares to the insider. Intuitively, since the worst-off type of outsider is the type with the lowest ability but the worst-off type of insider is of relatively high ability, allocating winning shares to the worst-off type of insider increases $\hat{U}_1\left(r,w,a_1^*(w,r)\right)$ by more than allocating winning shares to the worst-off type of outsider increases $\hat{U}_2\left(r,g,\underline{a}\right)$.

Consider the outsider's winning share, $1-g\left(r,\underline{s}\right)$. The worst-off type of outsider, $\underline{a}$, expects the insider to retain control with certainty, so $\hat{U}_2\left(r,g,\underline{a}\right)$ increases with $1-g$ at rate μ. On the other hand, an increase in $1-g$ (i.e. a lower g) increases the expected transfers in the mechanism, decreasing net surplus at rate $E[\tilde{a}]$. Hence, it is optimal to minimize $1-g$, setting it at the boundary, $\underline{s}$.[16] Thus, the insider typically receives some shares when surrendering control.

[16] Note that $g\left(r,\underline{s}\right)$ is unaffected by r because the gains of the worst-off type of outsider under the restructured organization are independent of r.

Corollary 1 *Unless dissolution is required* ($\underline{s} = 1$)*, the insider receives a strictly positive golden parachute when he surrenders control.*

In contrast, the optimal insider's winning share $w(r, \underline{s})$ satisfies $E_2[\tilde{a}|a_1^*(r, w(r, \underline{s}))] = E[\tilde{a}]$ for any interior solution. Intuitively, the optimal w is set so that a particular type of insider, the one who expects the firm to be worth exactly $E[\tilde{a}]$ under restructuring, is worst-off. This optimal type is of relatively high ability. There are two forces at play. On one hand, a higher w raises $\hat{U}_1(r, w, a_1^*(w, r))$. Using the envelope theorem, we see that $\hat{U}_1(r, w, a_1^*(w, r))$ increases with w at rate $E_2[\tilde{a}|a_1^*(r, w)]$, the expected value of the insider's shares conditional on being of type a_1^*. On the other hand, a higher w also increases the volume of expected transfers in the mechanism. It is easy to see that, for this reason, w lowers net surplus at rate $E[\tilde{a}]$. An interior $w(r, \underline{s})$ balances those two forces at the margin.[17] If r is sufficiently high, then $E_2[\tilde{a}|a_1^*(r, 1)] > E[\tilde{a}]$ and setting $w(r, \underline{s}) = 1$ is the best that the mechanism can do.

Note that the optimal share rule always avoids a particular management entrenchment scenario, where an insider with extremely high ability who participates in restructuring does not realize direct gains from trade. Suppose, for example, that control-only restructuring is impossible, $r > 1 - \underline{s}$. The case the mechanism designer wants to avoid is $w < r < 1$. For this share rule, the $a_1^*(r, w) = \overline{a}$ type of insider is worst-off because this type expects to both retain control with certainty and lose $r - w$ shares in the mechanism. Type $\overline{a}$'s net utility under the mechanism, $\hat{U}_1(r, w, a_1^*) = (w - r)\,\overline{a}$, is negative, so to get this type's participation requires a negative up-front payment k_1, a cash inducement, of at least that same magnitude. However, the gains to participating for the worst-off type of outsider,

[17] Note that $w(r, \underline{s})$ is not affected by $\underline{s}$. This stems from the assumption that $r \geq \underline{s}$.

net of the costs of running the mechanism, are not sufficient to finance such levels of cash inducement, and therefore it is impossible to efficiently restructure in this case.[18]

Now, as w increases above r, the payoff of the $\overline{a}$ type of insider increases further—so fast that this type is no longer worst-off. Indeed, the worst-off type of insider is now $F^{-1}\left(\frac{r}{w}\right) < \overline{a}$, and this type does realize direct gains from trade, equaling $wE_2[\tilde{a}|F^{-1}\left(\frac{r}{w}\right)] - rF^{-1}\left(\frac{r}{w}\right)$. It is no longer necessary to pay the insider to participate. Of course, it may still be necessary to pay the outsider. However, the additional net surplus from increasing w due to higher expected payoffs of high types more than compensates for the informational-rent costs of the additional trading of shares, creating enough resources to induce participation of the outsider. Hence, the gains to slacking the participation constraints exceed the extra costs, mitigating the entrenchment problem.

Note that the optimal share rule may set $w = r$, but only if initial ownership is extreme. If $r = 0$, then the lowest-possible type, $\underline{a}$, is the worst-off type of insider regardless of w. In that case, $E_2[\tilde{a}|\underline{a}] = \mu < E[\tilde{a}]$, so it is optimal to choose $w(r, \underline{s}) = 0$.[19] On the other hand, it is impossible to choose $w > r$ if $r = 1$, and $w(r, \underline{s}) = 1$ is optimal in that case.

[18]To see this, note that the worst-off type of outsider also needs to be bribed. Recall from Lemma 2 that efficient restructuring is possible with share rule (g, w) if and only if $\hat{U}_1(r, w, a_1^*(w, r)) + \hat{U}_2(r, g, \underline{a}) \geq (w - g)E[\tilde{a}]$, which in this case reduces to $(w - r)\overline{a} + (r - g)\mu \geq (w - g)E[\tilde{a}]$. As w increases, the left-hand side increases faster than the right-hand side, so it suffices to show this is impossible for $w = r$. Substituting and simplifying, we have $(E[\tilde{a}] - \mu)(g - r) \geq 0$. The highest value g can take is $1 - \underline{s}$, so the highest the left-hand side can be is $(E[\tilde{a}] - \mu)(1 - \underline{s} - r)$. Since we assumed $r > 1 - \underline{s}$, this term is negative.

[19]Strictly speaking, the second part of Proposition 3 is satisfied in the limit. As r approaches 0, w approaches 0 at a rate such that $E_2[\tilde{a}|a_1^*(r, w(r, \underline{s}))] = E[\tilde{a}]$. That is, the limiting worst-off type remains the one that expects the firm to be worth $E[\tilde{a}]$. Our example with uniform types (subsection 3.3) highlights this.

Corollary 2 *Unless the insider's initial ownership is extreme* ($r = 0$ *or* $r = 1$)*, the optimal share rule increases the insider's share ownership when he retains control.*

To summarize, if $r \in (0, 1)$, then $w(r, \underline{s}) > r$. Whenever possible, the optimal share rule chooses $w(r, \underline{s}) \in (r, 1)$ so that the worst-off type of insider expects the firm to be worth exactly $E[\tilde{a}]$ under restructuring. That is, the optimal share rule ideally maintains a separation of ownership from control when the insider retains control. When initial managerial ownership r is so high that it is impossible to equate $E_2[\tilde{a}|a_1^*(r, w(r, \underline{s}))] = E[\tilde{a}]$, then $w(r, \underline{s}) = 1$, the worst-off type of insider expects the firm to be worth more than $E[\tilde{a}]$, and the optimal share rule combines ownership and control when the insider retains control.

The last important feature of the optimal share rule is that $w(r, \underline{s})$ is such that the worst-off type of insider is not just of higher ability than the worst-off type of outsider, but strictly better than the average type: $F^{-1}\left(\frac{r}{w(r,\underline{s})}\right) > \mu$.

Corollary 3 *The optimal share rule yields a worst-off type of insider whose type is better than the average type.*

Proof. Recall that $E_2[\tilde{a}|a_1]$ is a strictly convex function of a_1. Hence Jensen's inequality implies

$$E_2[\tilde{a}|\mu] = E_2[\tilde{a}|E_1[a_1]] < E_1[E_2[\tilde{a}|a_1]] = E[\tilde{a}],$$

where the final equality follows from the law of iterated expectations. Thus, $E_2[\tilde{a}|\mu] < E[\tilde{a}]$ and the average insider expects the firm to be worth less than $E[\tilde{a}]$ under restructuring. Since $E[\tilde{a}] \leq E_2\left[\tilde{a}|F^{-1}\left(\frac{r}{w(r,\underline{s})}\right)\right]$ under the optimal share rule, it follows that $E_2[\tilde{a}|\mu] < E_2\left[\tilde{a}|F^{-1}\left(\frac{r}{w(r,\underline{s})}\right)\right]$, so that the average insider expects the firm to be worth less than what the worst-off type of insider expects it to be worth. Since $E_2[\tilde{a}|a_1]$ is a strictly increasing function of a_1, it follows that $F^{-1}\left(\frac{r}{w(r,\underline{s})}\right) > \mu$. ■

We can now turn to the study of the general circumstances under which efficient restructuring is possible. Plugging the optimal share rule into expression (14) for net surplus, we obtain

$$\widetilde{V}(r,\underline{s}) = w(r,\underline{s})\left\{E_2\left[\tilde{a}|F^{-1}\left(\frac{r}{w(r,\underline{s})}\right)\right] - E[\tilde{a}]\right\} + r\left\{\mu - F^{-1}\left(\frac{r}{w(r,\underline{s})}\right)\right\} + (1-\underline{s})\left\{E[\tilde{a}] - \mu\right\}. \quad (15)$$

We can use the value function $\widetilde{V}(r,\underline{s})$ to generate several striking predictions. First, consider an exogenous increase in the initial insider share, r. Using the envelope theorem, we have that

$$d\widetilde{V}(r,\underline{s})/dr = \mu - F^{-1}\left(\frac{r}{w(r,\underline{s})}\right) < 0, \quad (16)$$

which is negative since the worst-off type of insider, $F^{-1}\left(\frac{r}{w(r,\underline{s})}\right)$, is better than the average type (Corollary 3). Hence, low initial insider ownership facilitates efficient transfers of control.

Intuitively, a lower r slacks aggregate participation constraints of pivotal worst-off types of shareholders. Under the optimal share rule, each of the pivotal insider's initial shares is worth more to the insider than each of the pivotal outsider's initial shares are worth to the outsider, so aggregate participation constraints—the sum of the pivotal insider and pivotal outsider's status quo payoffs—are smaller when the insider initially owns fewer shares. There are two pieces to the intuition of this result. First, because any type of outsider knows the distribution of abilities but does not observe the actual ability of the manager, he expects the manager, absent restructuring, to be of average ability. Thus, the pivotal outsider values each initial share at the average level. Second, because the insider is the manager, any type of insider considering participating in the control contest knows his own ability and values each initial share at precisely that level. Because the pivotal insider is of above-average ability (Corollary 3), the pivotal insider values initial shares more than the pivotal outsider.

Thus, efficient restructuring is easier under lower ex ante insider ownership, that is, under greater ex ante separation of ownership from control. For sufficiently high values of r, efficient restructuring is impossible, as the next proposition shows.

Proposition 4 *The firm can be efficiently restructured if and only if* $r \leq \overline{r}$*, where* $\overline{r} < 1$ *unless* $\underline{s} = 0$*.*

Proof. Evaluating (15) at $r = 1$, we obtain

$$\tilde{V}(1, \underline{s}) = -\underline{s}\left\{E[\tilde{a}] - \mu\right\}.$$

The expression in brackets is strictly positive, so $\widetilde{V}(r, \underline{s}) < 0$ and efficient restructuring is unattainable if $\underline{s} > 0$. By continuity, the cutoff $\overline{r}$ is strictly below one except when $\underline{s} = 0$. ■

This result shows that some degree of ex ante separation of ownership from control is a necessary condition for efficient control reallocations. Note that this finding contrasts sharply with an independent private value setting, where the aggregate value of participation constraints for pivotal types is U-shaped as a function of a given player's share endowment, and equal-shares environments are best for efficient restructuring.

On the other hand, efficient restructuring is possible for any r when $\underline{s} = 0$. The value function is also continuous and decreasing in $\underline{s}$:

$$d\widetilde{V}\left(r,\underline{s}\right)/d\underline{s}=\mu-E[\tilde{a}]<0. \tag{17}$$

Given our assumption that $r\geq\underline{s}$, efficient restructuring is impossible for sufficiently high $\underline{s}$.

Proposition 5 *The firm can be efficiently restructured only if $\underline{s}$ is sufficiently low.*

Proof. For sufficiently high r, we know that $w=1$. Evaluating (15) at $w=1$ and $r=\underline{s}$, we obtain

$$\tilde{V}(r,r)=\left\{E_2\left[\tilde{a}|F^{-1}\left(r\right)\right]-rF^{-1}(r)\right\}-r\left\{E[\tilde{a}]-\mu\right\}-(1-r)\mu.$$

For $r=\underline{s}\simeq 1$, the first term in braces is very close to zero, so the entire expression is negative. ■

Thus, efficient restructuring is more difficult when a high managerial ownership is required. Intuitively, a higher $\underline{s}$ restricts the size of the optimal golden parachute, $g=1-\underline{s}$, raising informational rents.

Finally, there is also a relationship between the threshold ex ante ownership $\overline{r}$ and the threshold managerial ownership $\underline{s}$.

Proposition 6 *The threshold ex ante ownership $\overline{r}$ is decreasing in $\underline{s}$.*

This follows immediately from the fact that $d\widetilde{V}\left(r,\underline{s}\right)/dr<0$ and $d\widetilde{V}\left(r,\underline{s}\right)/d\underline{s}<0$. Intuitively, as $\underline{s}$ increases, the maximum golden parachute decreases, driving up the level of informational rents that must be paid when the manager is deposed, thus making efficient restructuring impossible for a larger set of r.

3.3 An Example

Let types be distributed uniformly on $[0,1]$. Applying Proposition 3 shows that $w(r,\underline{s}) = \min\{\sqrt{3}r, 1\}$, so that $a_1^* = \frac{1}{\sqrt{3}}$ if $r < \frac{1}{\sqrt{3}}$ and $a_1^* = r$ otherwise. We solve to find the highest value of r such that efficient restructuring is possible, for given $\underline{s}$. This threshold $\overline{r}$ is determined by setting $\widetilde{V}(r,\underline{s}) = 0$ and solving for r:[20]

$$\overline{r} \equiv \frac{1+\sqrt{1-\frac{4}{3}\underline{s}}}{2}. \tag{18}$$

Proposition 4 follows from (16) and (18). As $\widetilde{V}\left(\frac{2}{3},\frac{2}{3}\right) = 0$, it follows from (17) that $\widetilde{V}(r,\underline{s}) < 0$ for $\underline{s} > \frac{2}{3}$, as Proposition 5 states. Finally, Proposition 6 follows directly from (18).

Figure 2 summarizes the possibility of efficient restructuring by partitioning values of r and $\underline{s}$ into three sets of cases. Area I is the same indicated in Figure 2, where efficient restructuring with the control-only mechanism is feasible. Area II represents combinations of r and $\underline{s}$ such that efficient restructuring is achievable with the optimal mechanism ($\widetilde{V}(r,\underline{s}) \geq 0$) but not with a control-only mechanism. Equation (18) gives the upper boundary of this region. Area III shows the set of combinations of r and $\underline{s}$ such that efficient restructuring is impossible.

[20] Notice that expression (18) holds if $\underline{s} < \sqrt{3}-1$. If $\underline{s} \geq \sqrt{3}-1$, solving $\widetilde{V}(\overline{r},\underline{s}) = 0$ yields $\overline{r} = \frac{1-\underline{s}}{2\sqrt{3}-3}$, but this implies a cutoff value of $\overline{r}$ less than $\underline{s}$. Since we do not allow $r < \underline{s}$, there are no values of r such that efficient restructuring is possible in that case.

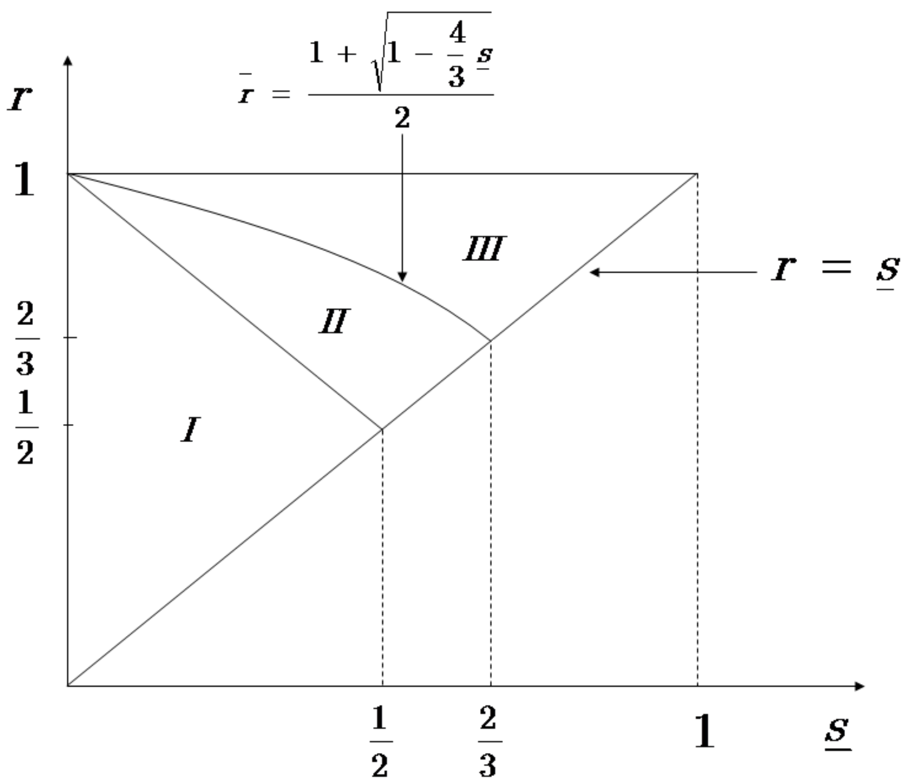

Figure 2: The Limits of Efficient Restructuring

3.4 More than Two Shareholders

The analysis of the case in which $n > 2$ involves no technical or conceptual additional difficulties, but is much more cumbersome. Importantly, our main results continue to hold and the basic intuition is the same. The optimal insider winning share balances mitigating managerial entrenchment against keeping informational rents from share trading low. It remains true that an insider retaining control captures additional shares ($w(r,s) \geq r$), though the size of $w(r,s)$ is affected by n. The worst-off type remains better than the average type, so higher initial managerial ownership makes efficient restructuring more difficult. The optimal outsider winning share keeps informational rents low by minimizing share trading. The optimal insider golden parachute is strictly positive.

Some features of efficient restructuring mechanisms do change in qualitatively important ways. The conditions under which control-only restructuring is possible shrink with more shareholders, because ex ante outsider shares are split among a larger number of outsiders. Control-only restructuring is inefficient for $r \geq \underline{s} > \frac{1}{n}$, because some shareholder must have less than $\underline{s}$ shares initially. On the other hand, restructuring using the optimal share rule is easier to implement because there are more expected gains to restructuring.[21]

For brevity, we omit a detailed analysis of the $n > 2$ case, which is available upon request.

4 Comparison with the Literature

To see our contribution more clearly, consider how our results compare with those from the mechanism design literature. Intuitively, efficient transfers of control are possible provided

[21] This last result mirrors a similar finding by Ornelas and Turner (2007).

that, fixed entry fees aside, the expected gains to participating for the worst-off type of shareholders, $\hat{U}_1(r, w, a_1^*(r, w)) + \hat{U}_2(r, g, a_2^*(r, w))$, exceed the expected transfers paid by the mechanism designer in implementing an M-mechanism. Indeed, $\hat{U}_1(r, w, a_1^*(r, w)) + \hat{U}_2(r, g, a_2^*(r, w))$ is an upper bound on the fees the mechanism designer can raise while achieving full participation. This same comparison drives the benchmark results of Myerson and Satterthwaite (1983) and Cramton, Gibbons and Klemperer (1987), as well as the more recent results of Ornelas and Turner (2007).

For each of these papers, winning and losing shares, worst-off types, net utilities and expected transfers are presented for the case of uniform types and $n = 2$ players in Figure 3. In the settings of those three previous papers, winning shares are 1 and losing shares are 0, i.e. they require full dissolution of the partnership upon reorganization. Because of this, expected transfers (far right column) equal $E[\tilde{a}] = \frac{2}{3}$. In contrast, our mechanism permits w and g to vary, so expected transfers equal $\frac{2}{3}(w - g)$. Regardless of the choice of w and g, expected transfers are no larger in our model than in any of the previous papers. This implies that the ability to reduce w and raise g facilitates efficient transfers of control.

In the settings of Cramton, Gibbons and Klemperer (1987) and Ornelas and Turner (2007), player 1's worst-off type equals his initial share and his net utility equals $\frac{1-r^2}{2}$.[22] In our model, as long as $w \geq r$, the worst-off type of insider is of type $\frac{r}{w}$, which equals r when $w = 1$. The insider's utility is therefore the same as in the other papers for $w = 1$. His

[22] This is true in Myerson and Satterthwaite (1983) as well, but they also impose the ex ante restriction $r = 1$.

	1's Win Share	1's Lose Share	a_1^*	$U_1(a_1^*)$	a_2^*	$U_2(a_2^*)$	$E\{\tau_1+\tau_2\}$
MS (1983)	1	0	1	0	0	$\frac{1}{2}$	$\frac{2}{3}$
CGK (1987)	1	0	r	$\frac{1-r^2}{2}$	$1-r$	$\frac{1-(1-r)^2}{2}$	$\frac{2}{3}$
OT (2007)	1	0	r	$\frac{1-r^2}{2}$	0	$\frac{r}{2}$	$\frac{2}{3}$
FOT (2013)	w	g	$\frac{r}{w}$	$\frac{w}{2}-\frac{r^2}{2w}$	0	$\frac{r-g}{2}$	$\frac{2}{3}(w-g)$

Note: There are two players in all cases, each with private information distributed uniformly on [0,1]. Player 1 is endowed with share r and player 2 with share $1-r$ (except for the MS case where $r=1$).

Figure 3: Comparing Mechanism Design Papers on Exchange Under Asymmetric Information

utility is strictly increasing in w:

$$\frac{d\hat{U}_1}{dw} = \frac{1}{2}\left[1 + \left(\frac{r}{w}\right)^2\right] > 0.$$

Thus, the insider's utility is lower than $\frac{1-r^2}{2}$ for w less than 1. Therefore, reducing w below 1 improves net surplus by more than in the received literature iff the marginal gain from reducing the expected transfers, $\frac{2}{3}$, exceeds the marginal cost evaluated at $w = 1$, $\frac{1}{2}(1 + r^2)$. This holds as long as $r < \frac{1}{\sqrt{3}}$.

In our model, player 2's worst-off type is always the lowest possible type, a feature shared with the model of Ornelas and Turner (2007), where control is modeled in the same way. Relative to Cramton, Gibbons and Klemperer (1987), our model's specification of asymmetric control hurts the possibility of efficient dissolution by making $\hat{U}_2(a_2^*)$ lower. Since player 2's reservation value does not depend on his type, his net utility from participating is just his utility from participating minus a constant. This function is minimized for $a_2^* = 0$, where $\hat{U}_2(0) = \frac{1-g}{2} - \frac{1-r}{2} = \frac{r-g}{2}$. Intuitively, this type of player 2 does better in our model's status quo, free riding off player 1 to earn expected payoff $\frac{1-r}{2}$, than in the Cramton, Gibbons and Klemperer's status quo, where he earns payoff 0. So there are fewer gains to participating in our setup. Because the worst-off type is a constant function of r in our model, $\hat{U}_2(a_2^*)$ is linear in r. These gains decrease with g at a rate equal to the per-share status quo payoff, $\frac{1}{2}$, which is below the marginal gain to reducing the expected transfers, $\frac{2}{3}$. Thus, the optimal share rule takes advantage of the fact that increasing player 2's winning share, $1-g$, has a relatively small positive effect on $\hat{U}_2(a_2^*)$.

5 Final Remarks

The main take-away message from our analysis is that separating ownership from control helps to enhance efficiency in the market for control. This result obtains in a model of closely-held firms. The force encouraging the separation of ownership from control stems from private information. We keep the model and the analysis simple whenever possible, to help us highlight the fundamental, qualitative nature of the economics driving the results. In doing so, we concentrate on fully characterizing the efficiency benchmark. In telling us what all specific mechanisms cannot achieve, our approach thus helps to explain the bounds and limits of the mechanisms that form the market for control.

Our theoretical results yield novel testable implications for the relationship between ownership and control, and also offer distinct interpretations for existing empirical findings. The separation of control from ownership that may be achieved through dual-class share structures (or other control-enhancing mechanisms) is usually seen as a (possibly inefficient) takeover defense. This may be so if ownership is dispersed and coordination problems among shareholders prevent efficient contracting. However, this argument is less appealing for closely-held firms with few large shareholders, where coordination problems tend to be less important. In fact, in their pioneering work on dual-class structures, DeAngelo and DeAngelo (1985, p. 53) claim that "observed arrangements represent voluntary agreements between managers and outside stockholders. These contracting parties have incentives to internalize all costs and benefits when they initially arrange the firm's ownership structure, and to recontract should new opportunities arise. Moreover, the contracting parties also bear opportunity costs in every period in which they forego the gains from removal of a sub-optimal ownership arrangement." Thus, we expect our theory to be particularly applicable for closely-held companies, where recontracting should be easier. Some preliminary evidence that dual-class recapitalizations may actually increase the likelihood of takeovers can be found in Bauguess, Slovin and Sushka (2012).

The optimal restructuring mechanism described in this paper implies that insiders should receive claims to the firm's future cash flows when giving up control. That is, golden parachutes (paid in shares) are essential in friendly restructurings. The role of golden parachutes as an incentive device to reduce management resistance to change is well understood. For example, Almazan and Suarez (2003) show that, in settings in which moral hazard problems are present, cash payments for deposed managers may be optimal. However, our model provides a novel rationalization of golden parachutes, as we show that there are efficiency reasons for also including ownership shares (rather than only cash transfers) as part of a deposed manager's compensation. In fact, despite the large literature on golden parachutes, we are not aware of any other theory that establishes stock compensation as a necessary part of a severance package.[23] Yet the empirical literature documents that golden parachutes that include equity-based pay are indeed pervasive.[24]

The optimal mechanism also implies that insider ownership should typically increase when the manager retains control after an ownership restructuring. Increases in management ownership after a management buyout are usually believed to be driven by incentive considerations. Our model shows that this need not be the only reason. Even when the current level of managerial ownership is enough to prevent private benefit extraction by managers, increasing management ownership after a buyout provides incentives to managers to participate in efficient ownership and control negotiations.

Now, since our analysis is about what the market for corporate control can achieve, it would be misleading to use our results to predict the outcomes of hostile mechanisms, such as proxy fights or tender offers.[25] Similarly, when efficient restructuring is impossible, second-best (but still Pareto-improving) mechanisms are the only feasible alternative. One promising approach to studying second-best mechanisms is to allow for divisible control. Assigning less-than-full control would sacrifice some efficiency in the ex post allocation, but could alter the incentive compatibility constraints in a way that lowers informational rents. This could help to facilitate restructuring in cases where ex ante ownership is prohibitively high. To improve our ability to explain the details of existing mechanisms of transferring

[23] Strictly speaking, we show that the optimal severance package for a departing manager must include compensation that is contingent on the value of the firm's equity after the change in control.

[24] See for example Lefanowicz, Robinson and Smith (2000) and Yermack (2006).

[25] There is a large literature that focuses on modeling and assessing the efficiency properties of specific mechanisms—e.g. Grossman and Hart (1980), Burkart (1995), Singh (1998).

control, future research should carefully consider such second-best mechanisms.

6 Appendix: Proof of Lemma 1

Proof. Under mechanism $\langle c, s, t\rangle$, shareholder i expects to receive transfer $T_i(a_i) \equiv E[t_i(\mathbf{a})]$. Thus, shareholder i's interim expected utility under an ex post efficient mechanism $\langle \mathbf{c}, \mathbf{s}, \mathbf{t}\rangle$ is

$$U_i^m(a_i, b) = s_i^1 a_i F(a_i) + s_i^0 \int_{a_i}^{\bar{a}} u dF(u) + T_i(a_i), \tag{19}$$

where the first argument of $U_i^m(.,.)$ is shareholder i's ability and the second is his announced ability.

The transfers that characterize an M-mechanism are given by

$$t_i(\mathbf{a}) = \begin{cases} -k_i & \text{if } s_i(a_i) = s_i^1 \\ (s_i^1 - s_i^0)\widetilde{a} - k_i & \text{if } s_i(a_i) = s_i^0, \end{cases} \tag{20}$$

where k_i is a real number. These transfers have the feature of being affected by the announcement of each shareholder in a direct mechanism only through its effect on the allocation of control. Per share, they are quite similar to the transfers from a standard Vickrey-Clarke-Groves mechanism.

To see that the M-mechanism is incentive compatible, note that conditional on all other shareholders declaring their types truthfully to the mechanism, shareholder $i \in N$ expects to receive a transfer of $T_i(b) = (s_i^1 - s_i^0)\int_b^{\bar{a}} u dF(u) - k_i$ by announcing his ability as b. In that case, the utility he achieves with the mechanism is

$$\begin{aligned} U_i^m(a_i, b) &= s_i^1 a_i F(b) + s_i^0 \int_b^{\bar{a}} u dF(u) + T_i(b) \\ &= s_i^1 a_i F(b) + s_i^1 \int_b^{\bar{a}} u dF(u) - k_i. \end{aligned} \tag{21}$$

Since $dU_i^m(b)/db = s_i^1 f(b)[a_i - b]$, it follows that $U_i^m(a_i, b)$ is maximized when $b = a_i$ (it is straightforward to check that the second-order condition is satisfied at this point), confirming that the mechanism is incentive compatible.

Fieseler et al. (2003) show that, with interdependent types, the interim expected utility of each agent under a mechanism that is both efficient and incentive compatible is determined up to a constant.[26] Thus, the transfers defined in (20) are the only ones that are both incentive compatible and ex post efficient: any efficient direct revelation restructuring mechanism implies cash transfers as in (20). ■

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