

Unbundling Ownership and Control*

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Abstract

We study optimal corporate control allocations under asymmetric information. We modify the canonical partnership dissolution model to allow for the endogenous determination of ex post ownership and control structures. Using a mechanism design approach, we fully characterize the optimal restructuring mechanism. This mechanism requires increasing the number of shares of the incumbent insider if he remains in control, while giving him a golden parachute that may include both stock and cash if he is deposed. The model exemplifies 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. The model generates several novel empirical predictions.

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1 Introduction

This paper studies control contests in the presence of asymmetric information. Our goal is to help explain and understand how efficiency in control contests affects, and is affected by, the relationship between ownership and control. We consider a model where valuations of ownership shares of a closely-held corporation are common across shareholders. In this model, which generalizes the partnership setting of Ornelas and Turner (2007), an efficient allocation requires that control be assigned to the candidate with the highest managerial ability but does not require the manager to own all shares. We use a mechanism design approach to show how altering share allocations in incentive-compatible mechanisms facilitates 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 restructurings under asymmetric information generally requires the *unbundling of ownership from control*. That is, reducing "winner" share allocations away from unity makes efficient restructuring easier. An important corollary is that managers who lose control receive compensation paid in shares.

Our main theoretical contribution is the introduction of optimal ex post ownership structures—which we call *optimal share rules*—and the characterization of their properties. Conditional on using an optimal share rule, efficient restructuring is unambiguously easier when the manager initially owns fewer shares, that is, when ownership and control are unbundled ex ante. This contrasts sharply 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 efficient bargaining is most likely for equal-shares endowments. In these standard cases, efficient bargaining implicitly requires ex post bundling of ownership and control, so mechanism designers lack the flexibility seen in our setting.

Reducing the share allocated to the "winner" of control away from unity has two primary effects. First, it reduces the number of shares that the winner must buy from the loser upon acquiring control; this reduces the informational rents required by incentive compatibility.¹

¹When winning shares are less than one, expected rents are strictly smaller than under bilateral exchange (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.

Second, it reduces shareholders' expected gains from participating in the control contest; this effect makes it more difficult to get 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. We determine the optimal winning shares for insiders and outsiders by trading off these two effects.

Optimal winning shares for insiders and outsiders are qualitatively distinct. For outsiders, reducing winning shares is unambiguously beneficial for control restructuring. Hence, the optimal share rule sets the outsider's winning share at the lowest possible level and sets the insider's losing share, his "golden parachute," at the highest possible level. For insiders, the two effects described above are at play and their balance determines the optimal winning share. We show that an efficient transfer of control using the optimal share rule typically maintains some separation of ownership from control.

We also identify novel ways in which the ex ante ownership structure is important. The reason low ex ante insider ownership facilitates efficient transfers of control is that asymmetric control yields asymmetric participation constraints. Under the optimal share rule, the total size of those constraints for pivotal types (whose identities change with the ownership endowment) is monotonically increasing in the ex ante ownership level of the insider. Specifically, a lower ex ante ownership structure reduces the total status quo payoff that the pivotal insider expects to get by more than it raises the pivotal outsider's status quo payoff, facilitating efficient restructuring.² This contrasts sharply with an independent private values setting, where the total size of participation constraints for pivotal types is U-shaped as a function of a given player's share endowment, so equal-shares environments facilitate efficient restructuring.

Thus, the optimal share rule leads to the unbundling of ownership from control, and some degree of ex ante unbundling is also necessary for efficient reallocations of control. Our theoretical findings yield several specific empirical predictions concerning transfers of control in closely-held companies. These predictions follow from the main theoretical results concerning the optimality of unbundling ownership and control, both ex ante and ex post.

²From a theoretical perspective, the key to understanding this is our result that the optimal pivotal, or "worst-off," type of insider is better than the average type. Since the worst-off type of insider's status quo value changes at the rate of his type, reductions in insider ownership lowers the status quo value at a rate higher than the average type. As initial insider ownership goes up, initial outsider ownership goes down. However, the outsider's status quo value changes at the rate of an average type, as this is what the outsider expects per-share profit to be under the status quo.

We discuss five main predictions. First, *ex ante* separation of control from ownership facilitates efficient transfers of control. Second, efficient transfers of control are more difficult when agency costs place bounds on the extent of control and ownership separation. Third, the negative effect of insider ownership on the likelihood of efficient transfers of control is more pronounced when potential agency costs are larger. Fourth, insiders must receive claims to the firm’s future cash flows when giving up control, i.e. golden parachutes (paid in shares) are essential in negotiated restructurings. Fifth, insider ownership typically increases when the manager retains control after an ownership restructuring.

To the best of our knowledge, this paper is the first to show explicitly the importance of separating ownership from control for efficient restructuring. Although we show this result in the context of closely-held companies, the main insight remains valid for any case in which there are at least two powerful parties with private information. Unlike previous explanations (e.g. Jensen and Meckling, 1976; Demsetz, 1983; Fama, 1980; Fama and Jensen, 1983), in our model the persistence of the separation between ownership and control relies on neither financing constraints nor risk aversion. Instead, it is driven by asymmetry of information and participation requirements.

The results are directly related to the literature on changes in corporate control and ownership (takeovers, asset sales, bankruptcy reorganizations, etc.). This literature usually focuses on explicit 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; and 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 theoretical underpinnings of our approach relate to Cramton, Gibbons and Klemperer (1987), the first paper to study efficient dissolution of partnerships in the presence of asymmetric information. That paper led to extensive work on dissolving partnerships—see for example McAfee (1992), Fieseler, Kittsteiner and Moldovanu (2003), Jehiel and Paudyal

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

(2006), and Ornelas and Turner (2007). Our analysis is also closely related to the recent contribution of Segal and Whinston (2011),⁴ who study the initial allocations that permit efficient bargaining in more general environments. 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). In Section 5 we provide microfoundations for the constraint on minimal managerial ownership that we assume in the basic model. We discuss the model's empirical implications in Section 6 and conclude in Section 7.

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. 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 distribution $F(a)$ on $[\underline{a}, \bar{a}]$.⁷ Profit, while

⁴See also Segal and Whinston (2010).

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

⁶Our 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.

⁷The 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

stochastic, is a linear function of managerial ability: $\Pi(a_i, \varepsilon) = a_i + \varepsilon$, with $E(\varepsilon | a_i) = 0$ and $Var(\varepsilon | a_i) > 0$, so that managerial ability is not ex post verifiable.⁸ Thus, under the initial control structure, the insider knows that expected profit will be $\pi = a_1$, whereas the outsider expects profit $E_1[a_1]$, where E_1 represents the expectation over the private information of shareholder 1. If upon restructuring the outsider becomes the manager, the firm's expected profit becomes $\pi = a_2$. For brevity, we henceforth drop the "expected" modifier to profit.

This specification allows us to study 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 in a relatively simple way. Our setup shares many of the same features as typical partnership dissolution models, but with two key distinctions. First, like Ornelas and Turner (2007), the value of shares is common across shareholders and is determined by the manager's type. Second, we depart from Ornelas and Turner (2007) in allowing 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 dissolution literature, $\underline{s} = 1$. Thus, the question about which ex post share structure should be chosen is moot. Allowing for $\underline{s} < 1$ permits many feasible ex post share rules to choose from, of which dissolution is just one special case. We show that this 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 affected by legal or institutional forces that govern the required minimum share necessary for acquiring control.

While the reasons behind \underline{s} are not important for our analysis, in Section 5, we provide a micro-foundation for \underline{s} based on an explicit model of agency costs. For now we simply

manager, one might have a more precise signal of a_1 than of a_2 . Still, since the case where the distribution of abilities is idiosyncratic is more cumbersome but yields little additional insights, we simplify the analysis by assuming that $F_1 = F_2 = F$.

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

note that our approach is a simple way of generalizing the canonical model of partnership dissolution, which assumes $\underline{s} = 1$. 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 (potentially new) manager 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 represents the expectation over the private information of both shareholders $\{1, 2\}$. Clearly, the surplus from restructuring under asymmetric information must be (weakly) lower than V^{fb} .

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 $\mathbf{a} = \{a_1, a_2\}$ and the mechanism determines (1) the new control structure $\mathbf{c}(\mathbf{a}) = \{c_1, c_2\}$; (2) the new ownership structure $\mathbf{s}(\mathbf{a}) = \{s_1, s_2\}$; and (3) net transfers paid to shareholders $\mathbf{t}(\mathbf{a}) = \{t_1, t_2\}$. 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 $\langle \mathbf{c}, \mathbf{s}, \mathbf{t} \rangle$ 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 to⁹

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

⁹The case where the two shareholders tie for highest type is a zero probability event and can be ignored.

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

$$s_i^1 \geq \underline{s}. \quad (2)$$

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.¹⁰ As shown by Segal and Whinston (2011), such nonconvexities can make efficient bargaining 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 \mathcal{M} -mechanisms.

Definition 1 *\mathcal{M} -mechanisms are a family of mechanisms with the following characteristics:*

1. *Each shareholder pays a (potentially 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: $(s_1^1, s_2^0) = (w, 1 - w)$ if the insider retains control, $(s_1^0, s_2^1) = (g, 1 - g)$ if the outsider gains control, with $w \geq \underline{s}$ and $1 - g \geq \underline{s}$; and*
5. *the shareholder who does not get control receives a (potentially negative) ex post transfer $\tau_i = (w - g)b_j, j \neq i$.¹¹*

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

¹⁰The 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.

¹¹When 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.

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

Four parameters characterize an \mathcal{M} -mechanism, which we denote $\mathcal{M}(k_1, k_2, w, g)$. The *winning share* for the insider, w , and his *golden parachute*, g , determine the ex post share allocation. We therefore call (w, g) 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 \mathcal{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 \mathcal{M} -mechanism permits a broader set of ex post share rules.

An \mathcal{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 satisfies¹²

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

To understand the intuition behind budget-balanced \mathcal{M} -mechanisms, consider first what happens when $w > g$. Without transfer τ_1 , the insider would have an incentive to exaggerate

¹²The 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.

his ability to increase the probability of being given the higher "winning" share. To counter such incentives, an \mathcal{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 $\mathcal{M}(k_1, k_2, w, g)$, he expects to obtain

$$\begin{aligned} \Pr(a_2 \leq a_1)wa_1 + \Pr(a_2 > a_1)E_2[ga_2 + (w - g)a_2 \mid a_2 > a_1] \\ = wE_2[\tilde{a}|a_1], \end{aligned}$$

where E_2 represents the expectation over the private information of shareholder 2. Since the insider obtains utility ra_1 if there is no restructuring, his expected net utility from participating in the mechanism is then

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

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: $U_1(r, w, k_1, a_1^*) \geq 0$. Minimizing (4) with respect to a_1 , we find

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

Intuitively, $a_1^*(w, r) = F^{-1}(\frac{r}{w})$ is the worst-off type because he expects to be neither a buyer nor a seller under the mechanism (and therefore cannot capitalize on his private information to earn extra rent). When $\frac{r}{w} \geq 1$, a corner solution obtains, and the worst-off type of manager is the highest type.

Similarly, the net utility of the outsider is given by

$$U_2(r, g, k_2, a_2) = (1 - g)E_1[\tilde{a}|a_2] - k_2 - (1 - r)E_1[a_1]. \quad (6)$$

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 $E_1[a_1]$, 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:

$$\hat{U}_i(r, w, a_i) = U_i(a_i) + k_i.$$

An \mathcal{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 \mathcal{M} -mechanism that is (ex ante) budget balanced and individually rational exists if and only if*

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

Proof. A necessary condition for participation by all types is

$$U_1(r, w, k_1, a_1^*) + U_2(r, g, k_2, a_2^*) \geq 0, \quad (8)$$

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

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

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

$$k_1 + k_2 \geq E[\tau_1 + \tau_2]. \quad (10)$$

Since $E[\tau_1 + \tau_2] = (w - g)E[\tilde{a}]$ for an \mathcal{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

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

which implies that condition (7) can be rewritten as

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

which is equivalent to

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

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 (w, g) . For example, the full dissolution share rule $(w = 1, g = 0)$ 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.¹³

3 Efficient Restructuring

While combining ownership and control ex post clearly creates problems for efficient restructuring, asymmetric information *per se* is actually 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 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, $\mathcal{M}(0, 0, r, r)$, control may switch from the insider to the outsider, but no shares change hands. Though strikingly simple, this is an \mathcal{M} -mechanism and is therefore incentive compatible.¹⁴ Moreover, because both shareholders keep their shares ($w = g = r$), they benefit proportionally from the gains from reallocating

¹³See Ornelas and Turner (2007) for a detailed analysis of this specific case.

¹⁴Note that truth-telling is not a dominant strategy in a control-only mechanism. For example, if shareholder i announced ability \underline{a} , shareholder j would strictly prefer to declare \underline{a} as his ability if he believed his type to be worse than average. Generally, dominant strategy implementation is not possible with interdependent types, because of off-equilibrium-path scenarios such as this one.

control. Because this mechanism does not require any exchange of money, budget balance and individual rationality hold easily.

Importantly, the control-only mechanism implies ex post separation of ownership from control: because $w = g = r$, 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.

Hence, unless there is a need for trading shares in a restructuring event, the control-only mechanism implements the first-best allocation. However, if $\underline{s} > 0$ then control-only restructuring does not work when ex ante ownership is concentrated in the hands of a single shareholder. That is, if $r = 1$ and $\underline{s} > 0$, the control-only mechanism could result in a manager with zero ex post share ownership, which may 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

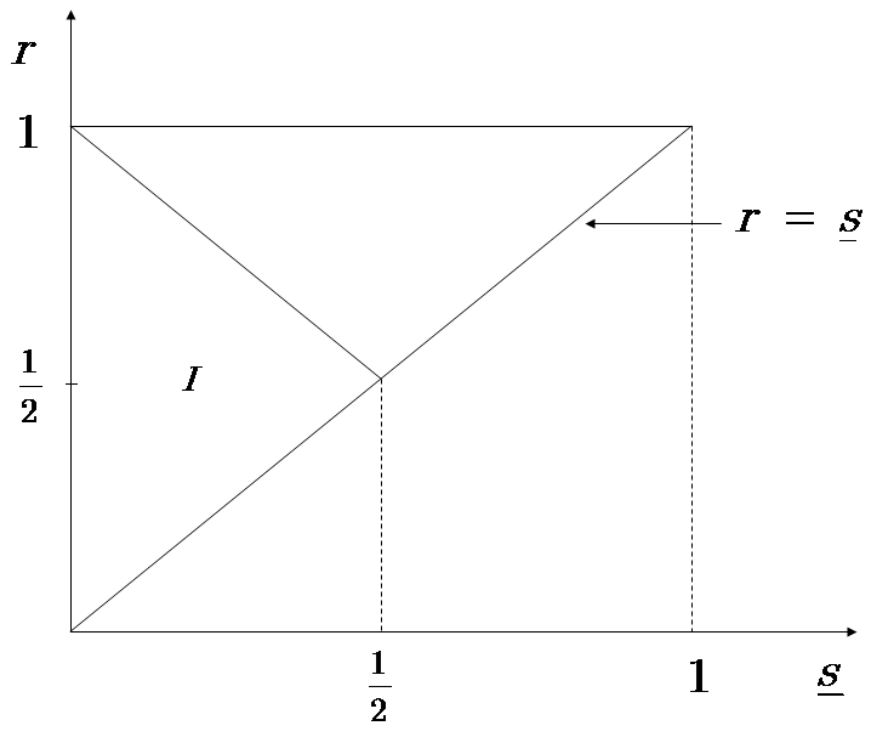


Figure 1: Control-Only Restructuring

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 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:

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

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 winning share w and golden parachute g in non-trivial ways. The insider's winning share affects the payoff to the worst-off type of insider directly and indirectly (through its affect on the identity of the worst-off type). The insider's golden parachute affects the payoff to the worst-off type of outsider directly. Both w and g affect the level of the transfers in the mechanism.

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

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

where \mathbf{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 $[w(r, \underline{s}), g(r, \underline{s})]$.

The next proposition fully characterizes the optimal share rule.

Proposition 2 The optimal share rule is unique and specifies

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

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

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

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

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

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

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

The optimal share rule has several important implications, which we discuss in turn. First consider the optimal insider's losing share, $g(r, \underline{s})$. Expected transfers decrease with g at a constant rate of $E[\tilde{a}]$, because the number of shares traded under the mechanism is lower when g is higher. Increases in g decrease the outsider's expected payoff, as the outsider's expected shares under the mechanism equal $1 - g$. For the worst-off type of outsider, type \underline{a} , these shares are worth $E_1[a_1]$, as the \underline{a} type expects the insider to retain control with certainty. Since the constant gains to increasing g , $E[\tilde{a}]$, exceed the constant costs, $E_1[a_1]$, the optimal share rule sets g as high as possible. This equates the outsider's winning share $1 - g$ to the minimum share requirement, \underline{s} .¹⁶ Thus, the insider typically receives some shares when surrendering control.

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

Consider now the optimal insider's winning share. In essence, the individual rationality constraints create a problem of management entrenchment and the optimal winning share $w(r, \underline{s})$ mitigates this problem. To get all types of insiders to participate, the mechanism must cater to higher-than-average types whose participation is expensive to secure. Intuitively, w balances inducing participation of the pivotal worst-off type of insider versus the cost of the transfers necessary to operate the mechanism. While expected transfers increase with w at a constant rate of $E[\tilde{a}]$, the rate by which w affects the insider's expected gains to

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

participating varies depending on the level of w . Recall that the worst-off type of insider's utility under the mechanism, net of the up front fee, is

$$\hat{U}_1(r, w, a_1^*) = wE_2[\tilde{a}|a_1^*(r, w)] - ra_1^*(r, w).$$

Using the envelope theorem, we see that gains from participation increase 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^* .

Suppose then that $w \leq r$ and $r > 0$. In this case, the number of shares traded is kept relatively small, but the $a_1^*(r, w) = \bar{a}$ type is worst-off because this type expects to both retain control with certainty and lose $r - w$ shares in the mechanism.¹⁷ This is the most expensive entrenchment scenario, as the insider's expected payoff under the mechanism, $(w - r)\bar{a}$, is negative. The marginal gains from participation increase with w at rate $E_2[\tilde{a}|\bar{a}] = \bar{a}$, which strictly exceeds the marginal cost of additional shares traded, $E[\tilde{a}]$. Thus, it is clearly not optimal to choose $w \leq r$.¹⁸

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.*

If $w > r$, then the type- \bar{a} insider is not worst-off, because this type expects to gain shares of value \bar{a} for certain under the mechanism. Instead, type $F^{-1}(\frac{r}{w})$ is worst-off, as this type expects to neither buy nor sell shares under the mechanism. This reduces the entrenchment problem, because type $F^{-1}(\frac{r}{w})$ enjoys a *positive* expected utility of $wE_2[\tilde{a}|F^{-1}(\frac{r}{w})] - rF^{-1}(\frac{r}{w})$ under the mechanism. The marginal gain to increasing w is decreasing in w and equals $wE_2[\tilde{a}|F^{-1}(r)]$ when $w = 1$. Thus, $w(r, \underline{s})$ satisfies $E_2[\tilde{a}|F^{-1}(\frac{r}{w(r, \underline{s})})] \geq E[\tilde{a}]$.¹⁹ If $E_2[\tilde{a}|F^{-1}(r)] < E[\tilde{a}]$, which clearly holds if r is sufficiently low, then $w(r, \underline{s}) < 1$ exactly solves $E_2[\tilde{a}|F^{-1}(\frac{r}{w(r, \underline{s})})] = E[\tilde{a}]$.

From this solution, we obtain an important implication for the relative magnitude of the optimal worst-off type of insider, $F^{-1}(\frac{r}{w(r, \underline{s})})$. Since $E[\tilde{a}] = E_1[E_2[\tilde{a}|a_1]]$ by the law of iterated expectations and $E_2[\tilde{a}|a_1]$ is a convex function of a_1 , Jensen's inequality implies

$$E_2[\tilde{a}|E_1[a_1]] < E[\tilde{a}].$$

Since $E_2[\tilde{a}|a_1]$ is an increasing function of a_1 , it follows that $F^{-1}(\frac{r}{w(r, \underline{s})}) > E_1[a_1]$.²⁰

¹⁷When $r = 0$, the insider has no shares to lose, so the worst-off type $a_1^* = \underline{a}$ is the type that expects his shares to have the lowest possible value under the mechanism.

¹⁸If $r = 1$, it is not possible to make $w > r$, so $w = r$ is optimal.

¹⁹Note that $w(r, \underline{s})$ is not affected by \underline{s} . This stems from the assumption $r \geq \underline{s}$ in this simpler version of the model where \underline{s} is given exogenously.

²⁰ If r is so high that $w = 1$ is optimal, then $a_1^* = r$ and $E_2[\max\{r, a_2\}|r]$ strictly exceeds $E[\tilde{a}]$.

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

The optimal mechanism, in promising better than average expected profits to insiders to induce the participation of all types, does not eliminate the entrenchment problem.

Hence, the optimal share rule generally separates ownership from control. For sufficiently low r and less-than full dissolution ($\underline{s} < 1$), the mechanism sets $w(r, \underline{s}) < 1$ and $g(r, \underline{s}) > 0$, guaranteeing that the shareholder winning control is allocated less than full ownership. The main intuition is lowering the winning share below unity reduces the number of shares traded in the mechanism, lowering informational rents. This is balanced against a need to reduce managerial entrenchment of the insider and to prevent agency costs in case the outsider wins control.

Plugging the optimal share rule into the expression (14) for net surplus, we define the value function as $\tilde{V}(r, \underline{s}) \equiv \max_{(w, g) \in \mathbf{B}} V(r, \underline{s}, w, g)$:

$$\begin{aligned} \tilde{V}(r, \underline{s}) \equiv & w(r, \underline{s}) \left\{ E_2 \left[\tilde{a} | F^{-1} \left(\frac{r}{w(r, \underline{s})} \right) \right] - E[\tilde{a}] \right\} \\ & + r \left\{ E_1[a_1] - F^{-1} \left(\frac{r}{w(r, \underline{s})} \right) \right\} + (1 - \underline{s}) \{ E[\tilde{a}] - E_1[a_1] \}. \end{aligned} \quad (15)$$

Note that the first term in braces vanishes if the optimal w is less than one. We now show that the possibility of efficient restructuring with $[w(r, \underline{s}), g(r, \underline{s})]$ is necessary and sufficient for the possibility of efficient restructuring generally.

Proposition 4 *The firm can be efficiently restructured if and only if $\tilde{V}(r, \underline{s}) \geq 0$.*

Proof. 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,

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

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

The value function has several striking features. First, it is continuous and decreasing in r . Using the envelope theorem, we see that

$$d\tilde{V}(r, \underline{s})/dr = E_1[a_1] - F^{-1} \left(\frac{r}{w(r, \underline{s})} \right) < 0, \quad (16)$$

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 (Proposition 3). Thus, efficient restructuring is easier under lower ex ante insider ownership, that is, under greater ex ante separation of ownership from control. Intuitively, participation constraints loosen as r decreases. When r falls, the utility of the worst-off type of insider under the status quo decreases at rate $F^{-1}\left(\frac{r}{w(r,\underline{s})}\right)$, so his net utility from participating in the mechanism increases at the same rate. On the other hand, as r decreases the status quo utility of the worst-off type of outsider increases at the rate of the average-ability insider, $E_1[a_1]$, so his net utility from participating in the mechanism decreases at the same rate. Proposition 3 ensures that the former effect dominates the latter, implying that a reduction in the initial managerial ownership enhances the possibility of efficient restructuring. Indeed, for sufficiently high values of r , efficient restructuring is impossible, as the next corollary shows.

Corollary 3 *The firm can be efficiently restructured if and only if $r \leq \bar{r}$, where $\bar{r} < 1$ unless $\underline{s} = 0$.*

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

$$\tilde{V}(1, \underline{s}) = -\underline{s} \{E[\tilde{a}] - E_1[a_1]\}.$$

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

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} :

$$d\tilde{V}(r, \underline{s})/d\underline{s} = E_1[a_1] - E[\tilde{a}] < 0. \quad (17)$$

Under the assumption that $r \geq \underline{s}$, we obtain that efficient restructuring is impossible for sufficiently high \underline{s} .

Corollary 4 *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 $\underline{s} = r$, we obtain

$$\tilde{V}(r, r) = \left\{ E_2 \left[\tilde{a} \left| F^{-1} \left(\frac{r}{w} \right) \right] - r F^{-1}(r) \right\} - r \{E[\tilde{a}] - E_1[a_1]\} - (1-r)E_1[a_1].$$

For r sufficiently close to 1, the first term in braces gets sufficiently 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 \bar{r} and the threshold managerial ownership \underline{s} .

Corollary 5 *The threshold ex ante ownership \bar{r} is decreasing in \underline{s} .*

This follows immediately from the fact that $d\tilde{V}(r, \underline{s})/dr < 0$ and $d\tilde{V}(r, \underline{s})/d\underline{s} < 0$. 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 .

3.2.1 An Example

Let types be distributed uniformly on $[0, 1]$. Applying Proposition 2 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. Applying Proposition 4, we solve to find the highest value of r such that efficient restructuring is possible, for given \underline{s} . This threshold \bar{r} is determined by setting $\tilde{V}(r, \underline{s}) = 0$ and solving for r .²¹

$$\bar{r} \equiv \frac{1 + \sqrt{1 - \frac{4}{3}\underline{s}}}{2}. \quad (18)$$

Corollary 3 follows from (16) and the definition of \bar{r} . Since $\tilde{V}(\frac{2}{3}, \frac{2}{3}) = 0$, it follows from (17) that $\tilde{V}(r, \underline{s}) < 0$ for $\underline{s} > \frac{2}{3}$, as Corollary 4 states. Finally, Corollary 5 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 ($\tilde{V}(r, \underline{s}) \geq 0$) 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.

²¹Notice that expression (18) holds if $\underline{s} < \sqrt{3} - 1$. If $\underline{s} \geq \sqrt{3} - 1$, solving $\tilde{V}(\bar{r}, \underline{s}) = 0$ yields $\bar{r} = \frac{1-\underline{s}}{2\sqrt{3}-3}$, but this implies a cutoff value of \bar{r} less than \underline{s} . Since in the analysis of the basic model we do not allow $r < \underline{s}$, there are no values of r such that efficient restructuring is possible in that case.

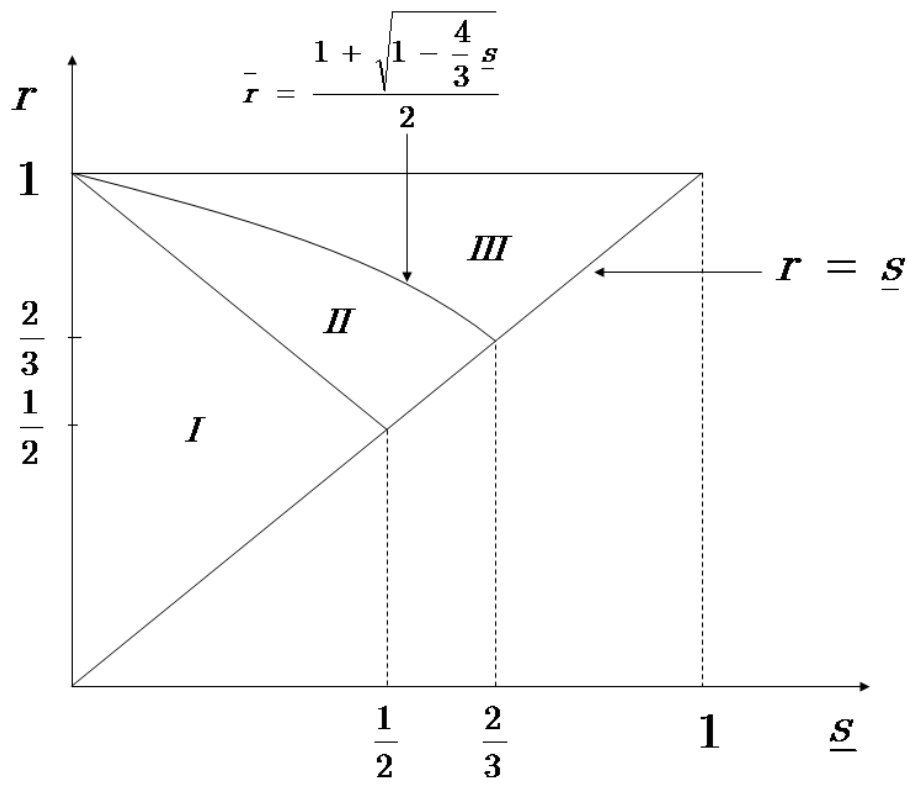


Figure 2: The Limits of Efficient Restructuring

3.3 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.²²

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 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 \mathcal{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 Table 1. In the settings of those three previous papers, winning shares are 1 and losing shares are

²²This last result mirrors a similar finding by Ornelas and Turner (2007).

	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 (2010)	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 $r=1$).

Table 1: Comparison of Mechanism Design Papers on Exchange Under Asymmetric Information

Figure 3:

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 $\frac{1-r^2}{2}$.²³ 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 utility is strictly increasing in w :

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

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.

²³This is true in Myerson and Satterthwaite (1983) as well, but they also impose the ex ante restriction $r = 1$.

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 $a_2^* = 0$. 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 less 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 Endogenous private benefit extraction

The minimum level of insider ownership \underline{s} is a crucial parameter in our analysis. Without such a restriction, efficient transfers of control could always be implemented by the control-only mechanism. In this subsection we provide a micro-foundation for \underline{s} by explicitly modeling a private benefit extraction mechanism. Doing so has also an additional advantage: it allows us to study the case in which the initial ownership structure generates agency costs ($r < \underline{s}$). We show that the conclusions of our reduced-form approach and of a model in which moral hazard considerations are modeled explicitly are virtually identical.

We model the extraction of private gains similarly to Burkart et al. (1998). In that model, the consumption of private benefits by the manager is inefficient, i.e. it is not simply a transfer from outside shareholders to the insider. We follow the same approach. Specifically, we assume that the insider uses a share γ of the firm’s profit to produce “share” $\delta(\gamma)$ for himself, which can be understood as perquisites that the insider consumes, leaving the residual share $1 - \gamma$ to be divided among the shareholders. Thus, under the ex ante ownership structure, the insider’s payoff is $[\delta(\gamma) + (1 - \gamma)r] a_1$ and the outsider’s payoff is $(1 - \gamma)(1 - r) a_1$. The allocation of corporate resources γ is a choice variable to the insider. We follow the technical assumptions of Burkart et al. (1998) that $\delta(\cdot)$ is twice continuously differentiable, increasing and concave in $[0, 1]$, with boundary conditions $\delta(0) = 0$ and $\delta'(1) = 0$. However, we relax their other assumptions in two important ways. First, we permit the marginal gain of initial extraction, $\delta'(0)$, to be any element of $[0, 1]$. This assumption implies that it might

be possible to eliminate the inefficient extraction of private benefits even if the insider does not own the entire firm. The stricter condition adopted by Burkart et al., that $\delta'(0) = 1$, implies that agency costs would be eliminated only if the manager owned all shares.²⁴

Second, we require $\delta(\gamma)$ to be strictly concave only if $\delta'(0) > 0$. Thus, we include a wide spectrum of specifications of private gains, including the case where no private gains are available ($\delta(\gamma) = 0$). Note that these assumptions guarantee inefficient extraction of private benefits, since $\delta(\gamma) < \gamma$ for all $\gamma > 0$. Thus, the specification of Burkart et al.'s for the extraction of private gains corresponds to the special case of ours where $\delta'(0) = 1$. Our generalization is important, since we do not want to assume that full combination of ownership and control is strictly necessary for efficiency.

The insider chooses to divert profits to private gains as to maximize his payoff:

$$\max_{\gamma \in [0,1]} [\delta(\gamma) + (1 - \gamma)r] a_1. \quad (19)$$

Therefore, the optimal choice of γ is given by

$$\gamma^* = \begin{cases} h(r) & \text{if } \delta'(0) > r \\ 0 & \text{if } \delta'(0) \leq r, \end{cases} \quad (20)$$

where $h \equiv (\delta')^{-1}$. Thus, for sufficiently small r , the insider diverts profits for his private gain. Since $\delta(\gamma) < \gamma$, this introduces agency costs. Notice that the (privately) optimal share of profits that the insider extracts does not depend on his ability, but is non-increasing in his ownership share. Moreover, $\gamma^* = 0$ if $r = 1$ and, unless $\delta(\gamma) = 0$, $\gamma^* = 1$ if $r = 0$.²⁵ Thus, agency costs are absent for all r only if $\delta(\gamma) = 0$.

In this setup, the minimum level of insider ownership that prevents private benefit extraction is given by

$$\underline{s} = \delta'(0). \quad (21)$$

Thus, provided that $\underline{s} = \delta'(0)$, under the assumption that $r \geq \underline{s}$ maintained so far all the previous analysis is unchanged even when we explicitly allow for private benefit extraction. But now we can consider also the case where $r < \underline{s}$. This corresponds to the set of parameters represented in the lower triangle of Figures 1 and 2.

²⁴There are other assumptions that would lead to the same result. For example, if there were fixed costs to extracting private benefits, perhaps because of a fixed expected punishment (such as reputation loss) in case the insider is caught, the extraction of private benefits could be eliminated even without giving all shares to the insider. Thus, while our assumption that $\delta'(0) \leq 1$ is probably the simplest, it is not the only way of generalizing the setup of Burkart et al. (1998).

²⁵If $\delta(\gamma) = 0$, the insider with $r = 0$ is indifferent between any level of private extraction.

To simplify exposition, here we assume that F is uniform on $[0, 1]$. Define $\beta(r) \equiv \delta(\gamma^*) + (1 - \gamma^*)r$, where γ^* is a function of r as given by (20). Now, the worst-off type of the insider is given by

$$a_1^* = \min \left\{ \frac{\beta(r)}{w}, 1 \right\}. \quad (22)$$

By performing the same calculations as before, we can generalize Proposition 2.

Proposition 2' *Let F be uniform on $[0, 1]$ and allow for endogenous private benefit extraction. Then, the optimal share rule is $[w(r, \underline{s}), g(r, \underline{s})] = [\min \{ \beta(r) \sqrt{3}, 1 \}, 1 - \underline{s}]$.*

The only change to the optimal share rule stems from the fact that the insider's *effective* ownership of cash flow right is $\beta(r)$, rather than r , when he extracts private benefits. It is straightforward to see that all the main qualitative results discussed before also hold in this case.

6 Model Implications

Our theoretical results have several clear-cut empirical implications. Some of them are entirely novel, while others offer distinct interpretations for previously studied results. We now discuss these implications.

Our first important prediction follows from Corollary 3.

Prediction 1 *Ex ante separation of control from ownership facilitates efficient transfers of control in closely-held firms.*

This result indicates that the likelihood of changes in control in negotiated transfers is decreasing in management ownership of cash flow rights. This is a unique prediction that has not yet been fully explored in the empirical literature.

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.

Prediction 1 helps to explain an interesting regularity uncovered by Bauguess, Slovin and Sushka (2008). Considering a sample of closely-held companies that recapitalized towards dual-class share structures and a matched sample of firms that kept a one share-one vote structure, they find that, in firms where control rights were initially fully in the hands of insiders, a reduction in insider ownership of cash flow rights (keeping control rights constant) is associated with a substantial increase in the likelihood of takeovers. Specifically, firms in the highest quartile of insider ownership in their recapitalization group were taken over 62% of the time in their sample period, while the matching firms that did not reduce their insider ownership were taken over only 32% of the time. To our knowledge, ours is the first model to rationalize this relationship between separation of control from ownership and likelihood of takeover.

Prediction 2 *Larger potential agency costs hamper efficient transfers of control.*

Our second empirical implication follows Corollary 4. It is important to clarify it. Prediction 2 does not say that companies with *observed* governance problems are more difficult to take over. Instead, it indicates that companies in which the *scope* for manager misbehavior is large should be more difficult to restructure, precisely because the extent to which ownership and control can be separated is limited by the threat of agency problems.

We are not aware of any work that directly tests for this prediction. But one could test it by comparing the takeover frequency in industries in which the scope for managerial discretion is higher with those where managerial discretion is lower. One possibility is to use an index of managerial discretion, as the one proposed by Hambrick and Abrahamson (1995).²⁶ Another popular measure of the scope for agency problems is stock return volatility (Demsetz and Lehn, 1985).

Prediction 3 *The negative effect of insider ownership on the likelihood of efficient transfers of control is more pronounced when potential agency costs are larger.*

²⁶See Adams, Almeida, and Ferreira (2005) for an application of that index in the finance literature.

This result follows from the observation that \bar{r} is decreasing in \underline{s} (Corollary 5), and is simply an interaction effect between insider ownership and potential agency costs. It provides a robustness check for any empirical attempt at testing Predictions 1 and 2 simultaneously.

Prediction 4 *Insiders must receive claims to the firm's future cash flows when giving up control; i.e. golden parachutes (paid in shares) are essential in friendly restructurings.*

Prediction 4 follows from the optimal share rule (Proposition 2), which specifies $g > 0$, i.e. departing insiders should retain some shares of the firm (unless the scope for agency costs is extreme).

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 cash payments for deposed managers can be used in incentive contracts to discipline their behavior. However, our model provides a novel rationalization of golden parachutes, as we show that there are efficiency reasons for including also ownership *shares* (rather than cash transfers only) 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.²⁷ Yet the empirical literature documents that golden parachutes that include equity-based pay are indeed pervasive.²⁸

Our fifth prediction points to how an ownership restructuring is likely to affect insider ownership.

Prediction 5 *Insider ownership typically increases when the manager retains control after an ownership restructuring.*

In our model, an ownership restructuring without changes in control is associated with an increase in insider ownership. This result follows from the optimal share rule (Proposition 2): the optimal winning share w is strictly greater than r unless $r = 1$ or $r = 0$. An ownership restructuring without control changes resembles a *management buy-out* (MBO). Kaplan (1989) finds that the median insider ownership increases from 5.9% to 22.6% after an MBO.²⁹

²⁷Strictly 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.

²⁸See for example Lefanowicz, Robinson and Smith (2000) and Yermack (2006).

²⁹Notice that an increase in managerial ownership of cash flow rights is not a necessity in MBOs. As in our model, if voting rights and cash flow rights can be separated, an MBO is a situation in which management's control of *corporate votes* increases.

Increases in management ownership after an MBO 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 an MBO provides incentives to managers to participate in efficient ownership and control negotiations.

7 Conclusion

We study the limits of control restructuring under information asymmetry. We employ a mechanism design approach that allows us to define the conditions under which efficient restructuring is not possible with any incentive compatible, individually rational mechanism that does not generate a budget deficit. We obtain some striking results. We first show that, if informational asymmetries are the only source of frictions, then efficient restructuring is *always* possible. This can be accomplished, for example, with a simple mechanism that assigns control to the most capable agent but leaves the ownership structure unchanged. Thus, efficient restructuring may not be feasible only when there are additional frictions.

A natural restriction on the ownership structure arises from moral hazard. If managerial ownership is too low, the manager may choose to inefficiently divert company's resources for private benefit. Efficient restructuring may therefore require a minimum of managerial ownership. This is the approach followed, for example, by the partnership dissolution literature, which requires 100% managerial ownership upon reorganization. We study the potential for efficient restructuring when this restriction is less than 100%. It is intuitive to see that, the lower is this restriction, the larger the potential for efficient restructuring will be.

To define the limits of efficient restructuring for any restriction on managerial ownership, we derive an *optimal share rule*. Efficient restructuring is possible if and only if it is achievable with the optimal share rule. This rule has several remarkable properties. It requires ex-post separation of control from ownership, because this moderates the informational rents created in the mechanism. This separation implies, for example, that there are efficiency gains in providing deposed managers with "golden parachutes," paid at least partially in shares. The optimal share rule also requires increased managerial ownership when the manager retains control after a restructuring, because this reduces management entrenchment. For the same reason, we show that ex-ante separation of control from ownership helps efficient transfers of control. As we discuss in detail in the paper, some of these results help to rationalize well-know empirical regularities that hitherto have been difficult to make sense of; others

provide novel testable implications that could be used to scrutinize our model empirically.

Putting all of our results together, the main take-away message from our analysis is that separating ownership from control helps to enhance efficiency in the market for corporate control. This result obtains in a model of closely-held firms without financing constraints or risk aversion. Hence, the force encouraging the separation of ownership from control here does not depend on limited entrepreneurial wealth or on diversification economies. Rather, it stems from private information. Thus, instead of replacing existing theories finding that the separation is an efficient, endogenous response to economic primitives, our model augments and reinforces those theories.

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 corporate control. It would however be misleading to use our results to predict the outcomes of hostile mechanisms, such as proxy fights or tender offers.³⁰

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

8 Appendix: Proof of Lemma 1

Proof. Under mechanism $\langle \mathbf{c}, \mathbf{s}, \mathbf{t} \rangle$, shareholder i expects to receive transfer $T_i(a_i) \equiv E_j \{t_i(\mathbf{a})\}$, where $E_j \{.\}$ denotes the expectation over a_j , $j \neq i$. Thus, shareholder i 's interim expected utility under an ex post efficient mechanism $\langle \mathbf{c}, \mathbf{s}, \mathbf{t} \rangle$ is

$$U_i^m(a_i, b) = s_i^1 a_i F(a_i) + s_i^0 \int_{a_i}^{\bar{a}} u dF(u) + T_i(a_i), \quad (23)$$

³⁰There 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).

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

The transfers that characterize an \mathcal{M} -mechanism are given by

$$t_i(\mathbf{a}) = \begin{cases} -k_i & \text{if } s_i(a_i) = s_i^1 \\ (s_i^1 - s_i^0)\tilde{a} - k_i & \text{if } s_i(a_i) = s_i^0, \end{cases} \quad (24)$$

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 \mathcal{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 $T_i(b) = (s_i^1 - s_i^0) \int_b^{\tilde{a}} u dF(u) - k_i$ by announcing his ability as b . In that case, the utility he achieves with the mechanism is

$$\begin{aligned} U_i^m(a_i, b) &= s_i^1 a_i F(b) + s_i^0 \int_b^{\tilde{a}} u dF(u) + T_i(b) \\ &= s_i^1 a_i F(b) + s_i^1 \int_b^{\tilde{a}} u dF(u) - k_i. \end{aligned} \quad (25)$$

Since $dU_i^m(b)/db = s_i^1 h(b)[a_i - b]$, 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.³¹ Thus, the transfers defined in (24) are the *only ones* that are both incentive compatible and ex post efficient: any efficient direct revelation restructuring mechanism implies cash transfers as in (24). ■

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