IFN Working Paper No. 817, 2010

Buying to Sell: A Theory of Buyouts

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January 2, 2010

Abstract

Private equity owned firms have more leverage, more intense compensation contracts, and higher productivity than comparable firms. We develop a theory of buyouts in oligopolistic markets that explains these facts. Private equity firms are more aggressive in inducing restructuring compared to incumbents since they maximize a trade sale price. The equilibrium trade sale price increases in restructuring not only by increasing the profit of the acquirer, but also by decreasing the profits of non-acquiring firms. Predictions on the exit mode and on when private equity firms can outbid incumbents in the market for corporate control are also derived.

Keywords: Acquisitions, Buyouts, Buy-to-sell, Buy-to-keep, Leveraged Buyouts, Private equity, Take-overs, Temporary ownership

JEL Codes: G24, G32, G34, L1, L2

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*Financial support from the Marianne and Marcus Wallenberg Foundation and the Jan Wallander and Tom Hedelius Foundation is gratefully acknowledged. This paper was written within the Gustaf Douglas Research Program on Entrepreneurship. We thank Kevin Amess, Ulf Axelsson, Florian Ederer, Denis Gromb, Björn Hansson, Ramana Sonti, and seminar participants at SIFR (the Institute for Financial Research), FSF (the Swedish Foundation for Small Business Research), the International Industrial Organization Conference 2009 in Boston, the 11th Annual SNEE European Integration Conference, the CAF Summer Research Conference (Indian School of Business, Hyderabad), 24th Annual Congress of the European Economic Association (Barcelona), The IFN Stockholm Conference on the Economics of Ownership, Organization and Industrial Development (Vaxholm) and The Research Institute of Industrial Economics (IFN) for excellent comments and suggestions. We also thank Aron Berg for research assistance. E-mail: firstname.lastname@ifn.se

1. Introduction

Private equity funds are important owners of corporate assets. As an asset class, private equity consists of more than 9000 funds raising more than $1.9 trillion. Buyout funds accounts for 63% of this amount (Ljungqvist et al., 2007). The existing literature on private equity buyouts (or leveraged buyouts) has emphasized that private equity firms are better at solving agency problems than public corporations. By giving the manager ownership in the firm, taking on debt and close monitoring, they make the management work harder at increasing profitability.

Yet, this approach fails to explain why boards of public companies do not implement the same measures to improve productivity. As expressed by Jensen (2007) *"Puzzling thing to me is that all of the techniques that PE uses to accomplish its value creation can be adopted by almost any public company [...] Yet it does not happen. [...] Seems to be due to the difficulty of changing the mindset of managers and boards. [...] Given the huge gains possible it is still a puzzle to me."*

We argue that this divergence can be explained by the fact that private equity firms buy assets with the intent of selling them, whereas incumbent firms buy assets with the intent of keeping them. Maximizing the trade sale price instead of the product market profits implies that private equity firms are more aggressive in inducing restructuring since the equilibrium trade sale price increases in restructuring not only by increasing the profit of the acquirer, but also by decreasing the profits of non-acquiring firms.

To show this, we develop a model with several symmetric incumbents competing in an oligopoly. One firm, the target, has assets in need of restructuring, but lacks the resources to undertake this restructuring. The target can be sold to one of the incumbents, or to one of several competing private equity firms. Post acquisition, the new owner hires a manager to restructure the target, and gives her a linear compensation contract consisting of a fixed wage and a share of the product market profits. Restructuring raises the profits of the target, but reduces the profits for rivals in the product market. The private equity firm then exits its investment through a trade sale to one of the incumbents. Finally, product market competition takes place.

In this setting, and in line with empirical evidence, private equity firms endogenously give stronger incentive contracts to managers as compared to incumbents. The reason is that the trade sale price is more sensitive to the restructuring effort than product market profits. In equilibrium, the trade sale price consists of an incumbent's profits from owning the target in

relation to the profits if a rival incumbent obtains it. Since restructuring both increases the profits of owning the target (*the carrot effect*) and decreases the profits if a rival obtains the target (*the stick effect*), the trade sale price responds more strongly to the restructuring effort than product market profits (only consisting of the carrot effect). Thus, private equity firms buying to sell have incentives to induce more restructuring than incumbents buying to keep as the stick effect is only present in the trade sale price and not in the product market profits. This is why private equity firms give managers more intense incentive contracts. It also explains higher leverage, if taking on debt makes the manager work harder to avoid default.

But stronger incentives to restructure the target do not imply that private equity firms can outbid incumbents in the initial acquisition auction. Incumbents have incentives to preemptively acquire the target to prevent a buyout and the subsequent sale of an intensively restructured and competitive target back to the industry. To outbid incumbents, private equity firms must have a cost advantage in restructuring (arising from, for example, better knowledge and experience of the restructuring process, better networks, or tax advantages).

We then examine what factors can explain the increased frequency of private equity buyouts over the last decades. The transaction cost associated with acquisitions and buyouts can be substantial due to the cost of due diligence and legal and administrative procedures. Since private equity firms buy to sell, they incur the transaction cost associated with an acquisition twice, whereas incumbents that buy to keep only incur the transaction cost once. This implies that the share of private equity buyouts over incumbent acquisitions increases when transaction costs decrease.

Our model has several empirical implications fitting well with established empirical facts.[1] First, managers in private equity owned firms should have more intense compensation contracts, as the owners have stronger incentives to induce restructuring. Second, private equity owned firms should have higher productivity as a result of more restructuring efforts due to intense compensation contracts. This explains why private equity restructured targets have a better long-run operational performance than incumbent acquisitions.[2] Third, private equity owned firms should be more leveraged if debt is incurred to induce the manager to work harder.

We also provide additional empirical predictions. First, factors such as financial market de-

[1] See, for instance, the evidence presented in the overview article of Kaplan and Strömberg (2009)

[2] Note, however, that the equilibrium acquisition price will be so high that the acquiring firm's profit would be higher absent an active private equity market.

velopment that decrease the transaction costs should increase the share of private equity buyouts in relation to incumbent acquisitions, since transaction costs are incurred twice by private equity firms (both when acquiring and when selling assets). Second, regarding the exit mode, a private equity firm will exit through a trade sale instead of an IPO if the IPO costs are high or if the restructuring costs are not too convex. The reason is that the trade sale price increases faster in restructuring than the value of an IPO due to strategic product market effects. Third, targets exited through a trade sale rather than through an IPO should be associated with higher productivity due to more restructuring. Finally, private equity firms hit by a negative cost shock or a positive demand shock, would be more likely to be sold through a trade sale. The reason is that such shocks work the same way as increased restructuring effort.

Our paper relates to multiple literatures. The literature on private equity buyouts has proposed that buyout firms are specialists in solving managerial agency problems, mainly through closer monitoring, extensive use of debt and giving the manager ownership in the firm. Jensen (1989) argued that private equity ownership was superior to public ownership with dispersed shareholders and weak governance. Our contribution to this literature lies in tying the incentives to be "active" owners to temporary ownership. Thereby, we can explain why public firms do not implement the same measures for increasing profitability as private equity firms do. To the best of our knowledge, we also provide the first theory studying the equilibrium emergence of private equity firms. We underscore that private equity firms can only acquire assets in equilibrium if they have sufficient advantages from restructuring the firm, that is, if they as temporary owners complement more permanent owners of assets.

By developing a theory of buyouts incorporating an oligopolistic product market, we contribute to the literature on the interaction between financial markets and product markets.[3] This literature has shown that capital market constraints on an individual firm depend on product market competition, and that capital markets can constrain the product strategy of firms and influence the product market performance. We add to this literature by showing that ownership type (temporary or permanent) affects financial structure, and that financial structure, in turn, affects investment behavior and product market performance.

We also contribute to the literature on incomplete contracts. Hart and Moore (1990) show

[3]Contributions to this literature include Jensen and Meckling (1976), Brander and Lewis (1986, 1988), Maksimovic (1988), Bolton and Scharfstein (1990), Williams (1995), Phillips (1995), Chevalier (1995a,b) and Miao (2005).

that when parties write ex ante incomplete contracts, the ability to exercise residual control rights improves the ex post bargaining position of an asset owner. This increases the parties' incentive to make relationship-specific investments. Therefore, it is optimal to assign asset ownership to those with the most important relationship-specific investments. We add to this by showing that when investments are made in assets used in oligopolistic markets, ownership may not only be allocated due to its effect for the owners of the assets, but also for owners of related assets (rival incumbents).

Finally, we contribute to the literature on mergers which typically treats owner asymmetries and pre- and post-merger investments in a cursory way. An exception is Gowrisankaran (1999), who uses numerical methods to study the evolution of an industry allowing for entry, exit and investments as well as mergers.[4] We extend this literature to asymmetric owners (incumbents and private equity firms) and pre- and post-merger investments. Our approach is similar to that of Norbäck and Persson (2009), but while they consider an innovation brought to the market by an entrepreneur, and study a double moral hazard problems, we study private equity buyout firms and focus on the interaction between oligopolistic externalities, restructuring, managerial compensation, and debt.

We have organized the paper as follows. Section 2 presents and solves the model, while Section 3 explores a set of extensions. Section 4 then collects empirical implications of the model and relates them to existing evidence. We offer concluding remarks in Section 5.

2. The model

Our model departs from observed industry characteristics. We focus on four dimensions.

(i) The product market is oligopolistic. Many buyouts take place in either mature concentrated industries or quickly growing industries where target firms possess strategic assets.

[4] In general, a large set of papers, for instance Salant et al. (1983), Perry and Porter (1985), Deneckere and Davidson (1985) or Farrell and Shapiro (1990), clarifies how mergers affect prices, profits and welfare, depending on the market structure in various static oligopoly models. Such papers are sometimes referred to as the exogeneous merger literature since the firms that merge are exogeneously chosen. They are silent on the terms of the deal and do not address the kind of strategic concerns on which we focus. Recently, a literature on endogeneous mergers has emerged where the central question is who merges with whom; see, for instance, Horn and Persson (2001). We contribute to this line of the literature since a key question in our paper is whether the private equity firm or an incumbent ends up acquiring the target.

(ii) Private equity firms are fundamentally temporary owners of corporate assets. They are committed to sell the firms they acquire in their funds, because the fund has a limited time horizon after which it must be closed and the capital returned to investors. This suggests a four-stage game: initial acquisition, restructuring, exit and post-exit product market interaction.

(iii) Exit takes place through a trade sale. Kaplan and Strömberg (2009) report that conditional on having exited, 38% of all exits are trade sales, 24% are secondary buyouts (sale to another buyout firm) and 14% are IPOs.[5] We do, however, extend our model to also account for IPOs in Appendix A.3.

(iv) Post-acquisition, the new owner implements governance, financial and operational improvements to restructure the target. Kaplan and Strömberg (2009) survey the changes private equity firms implement in target firms and categorize them as governance, financial and operational engineering. To capture this, the new owners in our model decide on incentive contracts for the managers (governance engineering), and managers then decide on restructuring intensity (operational engineering). In an extension (Section 3.2), we develop a version of the model where debt replaces managerial ownership as a way of inducing managerial effort (financial engineering).

Formally, consider an oligopoly industry served by a set $\mathcal{I} = \{1, 2, .., i, ..., n\}$ of symmetric buy-to-keep incumbent firms, each possessing the basic assets necessary for producing. The industry also contains a firm called the target. The target's assets are in need of restructuring, but the target cannot undertake the process by itself (because of lack of cash or knowledge). The game proceed as follows (illustrated in Figure 2.1):

In Stage one, an acquisition of the target by incumbent i or by the private equity firm $j \in \mathcal{J} = \{1, 2, .., j, .., m\}$ takes place at the acquisition price S^1 determined in a first-price perfect information auction with externalities. That the auction has externalities implies that the value of winning to a bidder is determined *relative to* what happens if the bidder loses the auction.[6] The new owner type (l) is either a *"buy-to-keep"* incumbent ($l = k$) or a *"buy-to-sell"* private equity firm ($l = s$).

[5] 11% are unknown, 6% are bankruptcy or reorganization, 5% are sold to LBO-backed firms and 1% are sold to management.

[6] For more on these types of auctions, see for instance Jehiel et al. (1999) or Jehiel and Moldovanu (2000).

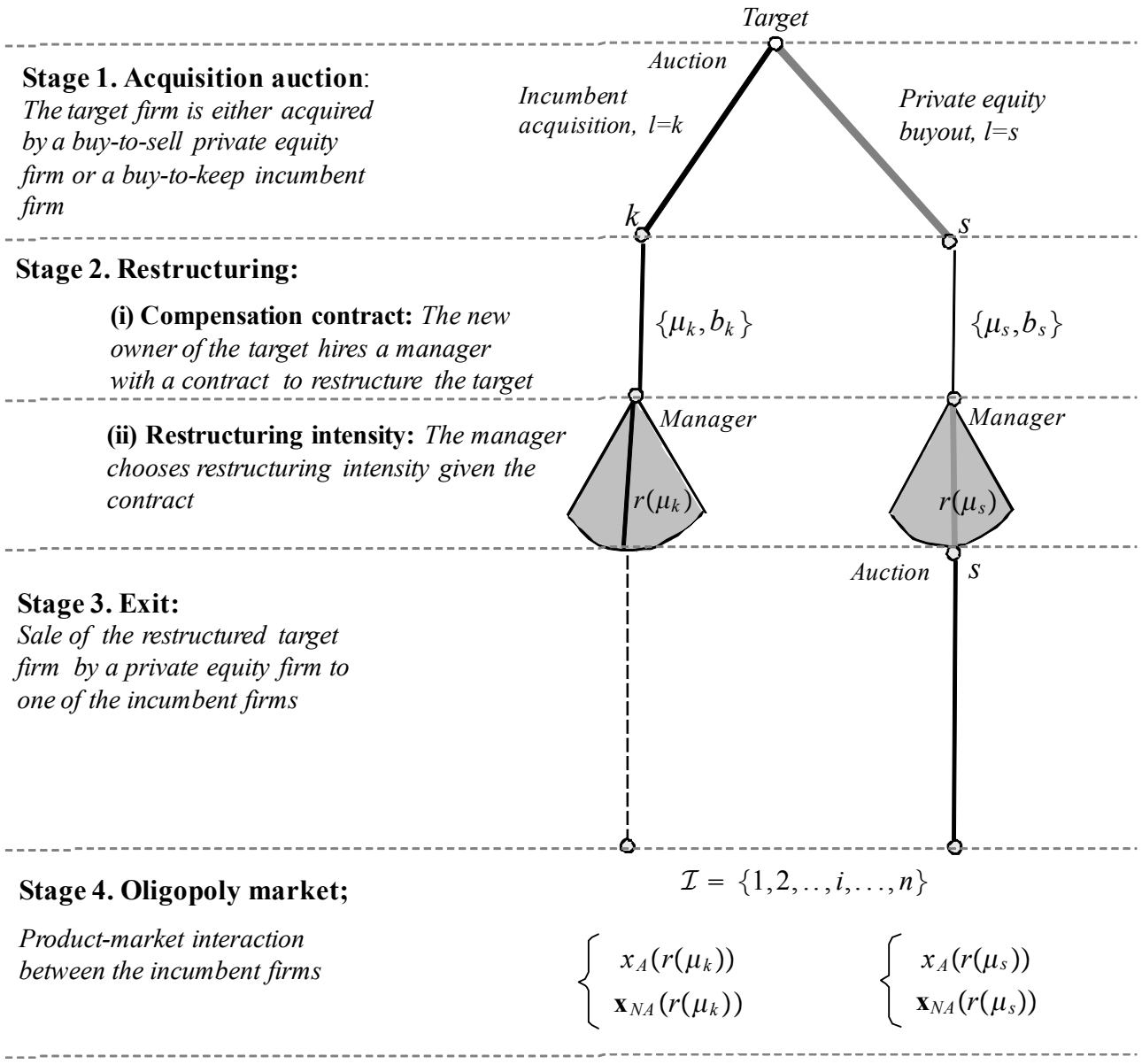

Figure 2.1: Timing. Here we illustrate and describe the four stage game we analyze: the initial acquisition auction, the restructuring and compensation stage, the exit auction, and oligopoly market interaction.

In Stage two, the new owner hires a manager to restructure the target. Because of moral hazard and risk aversion, the new owner must provide incentives for the manager to exert effort and offers the manager a share μ_l of the product market profits. The manager then determines the amount of restructuring, $r(\mu_l)$, to be undertaken.[7] To highlight how incentive problems affect restructuring, we will assume that incentive problems are only present during restructuring (Stage two), not in the product market interaction Stage (Stage four).

In Stage three, if the target was bought by a private equity firm, a trade sale of the target to one of the incumbents takes place. The trade sale price S^3 is determined through a first price perfect information auction with externalities.

In Stage four, incumbents compete in the product market by setting price or quantity (x_i), given the amount of restructuring undertaken in the target firm ($r(\mu_l)$).

2.1. Product market competition (Stage four)

Using backward induction, we start in Stage four with product market competition between the n incumbents. One of them owns the restructured target. Since product market competition takes place post-exit, private equity firms own no assets in this stage and thus, they cannot produce.

Each incumbent firm i chooses an action $\in R^+$ to maximize the direct product market profit $\Pi_i(x_i, x_{-i}, r, z)$. This profit depends on its own actions x_i; its rivals' actions $\mathbf{x}_{-i}$ (an $(N-1)\times 1$ vector); how much the target has been restructured (r); and the identity of the incumbent in possession of the target ($z \in I$). We assume a unique Nash-Equilibrium in actions, $\mathbf{x}^*(r, z)$, exists and that it is defined from the first-order conditions

$$\frac{\partial \Pi_i}{\partial x_i}(x_i^*, x_{-i}^*; r, z) = 0, \quad \forall i. \tag{2.1}$$

Using the ex-ante symmetry among incumbent firms, we can drop the ownership index z. Thus, we only need to distinguish between two firm types: the acquiring incumbent (A) and the non-acquiring incumbents (NA). Since the optimal action for the acquirer (x_A^*) and actions for the non-acquirers (x_{NA}^*) only depend on the level of restructuring r, we can define the reduced-

[7] We focus on offering an incentive contract on the product market profits under both ownership types. In section 3, we instead allow the private equity firm to offer the manager a share of the trade sale price.

form product market profits of the acquirer and a non-acquirer as direct functions of r:

$$R_A(r) \equiv \Pi_A(x_A^*(r), \underbrace{x_{NA}^*(r), ..., x_{NA}^*(r)}_{n-1}, r), \text{ and} \tag{2.2}$$

$$R_{NA}(r) \equiv \Pi_{NA}(x_{NA}^*(r), \underbrace{x_{NA}^*(r), ..., x_{NA}^*(r)}_{n-2}, x_A^*(r), r). \tag{2.3}$$

Restructuring increases the profits of the acquirer, but reduces the profits for non-acquiring incumbents as they must compete with a better rival.

Assumption A1: $\frac{dR_A}{dr} > 0$ and $\frac{dR_{NA}}{dr} < 0$

This holds, for example, in the Cournot model, where r reduces the marginal costs. It is also compatible with other oligopoly models (Farrell and Shapiro, 1990).

Example 1. *The Cournot model. Product market competition in Stage four is a Cournot-oligopoly in homogeneous goods with linear demand,* $P = a - \frac{Q}{s}$*, where* a *indicates consumer willingness to pay and* s *denotes market size. Direct product market profits are* $\Pi_h = (P - c_h)x_h$ *, where* x_h *is output for a firm of type* $h = \{A, NA\}$*. The marginal cost of an acquirer is* $c_A = c - r$ *and the non-acquirer have the marginal cost* $c_{NA} = c$*. Reduced-form profits then take the form* $R_h = \frac{1}{s}(q_h^*)^2$*, where* $q_A^* = \frac{a-c+nr}{n+1}$ *and* $q_{NA}^* = \frac{a-c-r}{n+1}$*. Hence,* $\frac{dR_A}{dr} > 0$ *and* $\frac{dR_{NA}}{dr} < 0$*.*

2.2. Exit (Stage three)

If a buyout took place in Stage one, the private equity firm exits its investment through a first price perfect information auction with externalities. The n incumbents simultaneously post bids, which are accepted or rejected by the private equity firm. Each incumbent announces a bid, b_i, where $b = (b_1, ..., b_i, ...b_n) \in R^n$ is the vector of these bids. The exit auction is solved for Nash equilibria in undominated pure strategies. There is a smallest amount, ε, chosen such that all inequalities are preserved if ε is added or subtracted. Following the announcement of b, the restructured target is sold to the incumbent with the highest bid. If more than one firm makes an offer of the highest value, each such incumbent obtains the target with equal probability.

An incumbent's valuation of obtaining the restructured target is

$$\omega_{kk} = R_A(r) - R_{NA}(r). \tag{2.4}$$

The first term shows the profit for an incumbent if it obtains the target. The second term shows the profit of the same incumbent if it does not obtain the target and must compete with

a rival who did. Since the incumbents are ex-ante symmetric, their valuations are symmetric. Denote the trade sale price in Stage three by $S^3(r)$. Lemma 1 follows.

Lemma 1. *The equilibrium trade sale price is* $S^3(r) = R_A(r) - R_{NA}(r)$.

Proof. See the appendix. ■

2.3. Managerial ownership and restructuring (Stage two)

The new owner of the target firm (a buy-to-keep incumbent firm or a buy-to-sell private equity firm) hires a manager at the beginning of Stage two to restructure the target. To induce a restructuring effort, the new owner gives the manager an equity share in the firm, that is, a share μ of the (future) product market profits net of restructuring costs. The restructuring costs, net of managerial compensation, are uncertain and given by $F - \varepsilon$, with $\varepsilon \sim N(0, \sigma^2)$.

We first solve the restructuring decision of the manager and then turn to the incentive contracts offered by the owner the target firm.

2.3.1. Restructuring effort by the manager for given incentive contract

First, consider the manager's decision on how much restructuring (r) to undertake given the equity share (μ). The more restructuring that is undertaken, the harder are the decisions the manager must take: the personal effort cost of restructuring is $C(r)$, with $C'(r) > 0$ and $C''(r) > 0$.[8] The restructuring undertaken by the manager is observed by the owner, but is not verifiable and cannot be contracted on. The manager is therefore offered a linear contract $\{b, \mu\}$ consisting of a fixed wage b and an equity share $\mu \in [0, 1]$ of the product market profits net of restructuring cost. The compensation given to the manager is then

$$w = b + \mu[R_A(r) - F + \varepsilon]. \tag{2.5}$$

The manager is risk averse and has CARA preferences, $u(w, r) = -e^{-\eta[w(b,\mu,r)-C(r)]}$, where η measures the degree of risk aversion. The manager exerts an effort to restructure the target by maximizing expected utility. To determine the amount restructuring undertaken, note that (2.5) implies that the manager's expected utility can be written:

$$\mathrm{E}[u(w, r)] = -e^{-\eta[b+\mu[R_A(r)-F]-C(r)]}\mathrm{E}[e^{-\eta\mu\varepsilon}]. \tag{2.6}$$

[8] In the context of the Cournot model in Example 1, this cost could correspond to $C(r) = \alpha\frac{r^2}{2}$.

Since $\varepsilon \sim N(0, \sigma^2)$ it follows that $\mathrm{E}[e^{-\eta\mu\varepsilon}] = e^{-\eta^2\mu^2\frac{\sigma^2}{2}}$. Defining $\Omega(\mu) = \eta\mu^2\frac{\sigma^2}{2}$ as the risk premium given to the manager to compensate her for taking on the restructuring risk, it follows that the optimal restructuring fulfills $r^* = \arg\max_r \mathrm{E}[u(w, r)] = \arg\max_r [b + \mu[R_A(r) - F] - C(r) - \Omega(\mu)]$. The associated first-order condition is

$$\mu\frac{dR_A}{dr} = C'(r^*(\mu)), \tag{2.7}$$

where $\mu\frac{dR_A}{dr}$ is the marginal increase in the manager's compensation and C' is the marginal increase in her effort cost.

From (2.7), we can note that the optimal restructuring undertaken by the manager $r^*(\mu)$ increases in equity share of the manager μ:

$$\frac{dr^*}{d\mu} = -\frac{R'_A}{\mu R''_A - C''} > 0, \tag{2.8}$$

where we have used the short notation $R'_A = dR_A/dr$ and $R''_A = d^2R_A/dr^2$, and where we have assumed that the second-order condition $\mu R''_A - C'' < 0$ is satisfied. The optimal restructuring is depicted as the upward-sloping locus $r^*(\mu)$ in Figure 2.2(i).

From (2.7), it is also convenient define reduced-form expressions for the profit functions of the incumbents $R_h(\mu) \equiv R_h(r^*(\mu))$ for $h = \{A, NA\}$; the compensation contract to the manager $w(b, \mu) \equiv b + \mu[R_A(r^*(\mu)) - F + \varepsilon]$; and for the effort cost of the manager, $C(\mu) \equiv C(r^*(\mu))$.

2.3.2. The incentive contract offered by a buy-to-keep incumbent

Suppose now that a buy-to-keep incumbent firm has obtained the target in Stage one. The incumbent will maximize her expected profits $\mathrm{E}[R_A(\mu) - F + \varepsilon - w(b, \mu)]$ by optimally choosing the contract $\{b, \mu\}$ given to the manager. Assuming perfect competition between managers, the optimal contract must fulfill the participation constraint $w(b, \mu) - C(\mu) - \Omega(\mu) = \bar{w}$, where $\bar{w}$ is the outside option for the managers. Solving $w(b, \mu) = \bar{w} + C(\mu) + \Omega(\mu)$ from the participation constraint, and using $\mathrm{E}[\varepsilon] = 0$, the expected profit for the incumbent can be written as

$$\mathrm{E}[R_A(\mu) - F + \varepsilon - w(b, \mu)] = R_A(\mu) - \Gamma(\mu), \tag{2.9}$$

where $\Gamma(\mu) = F + \bar{w} + C(\mu) + \Omega(\mu)$ is the total costs for inducing restructuring, i.e. the sum of the expected fixed restructuring cost and the compensation paid to the manager.

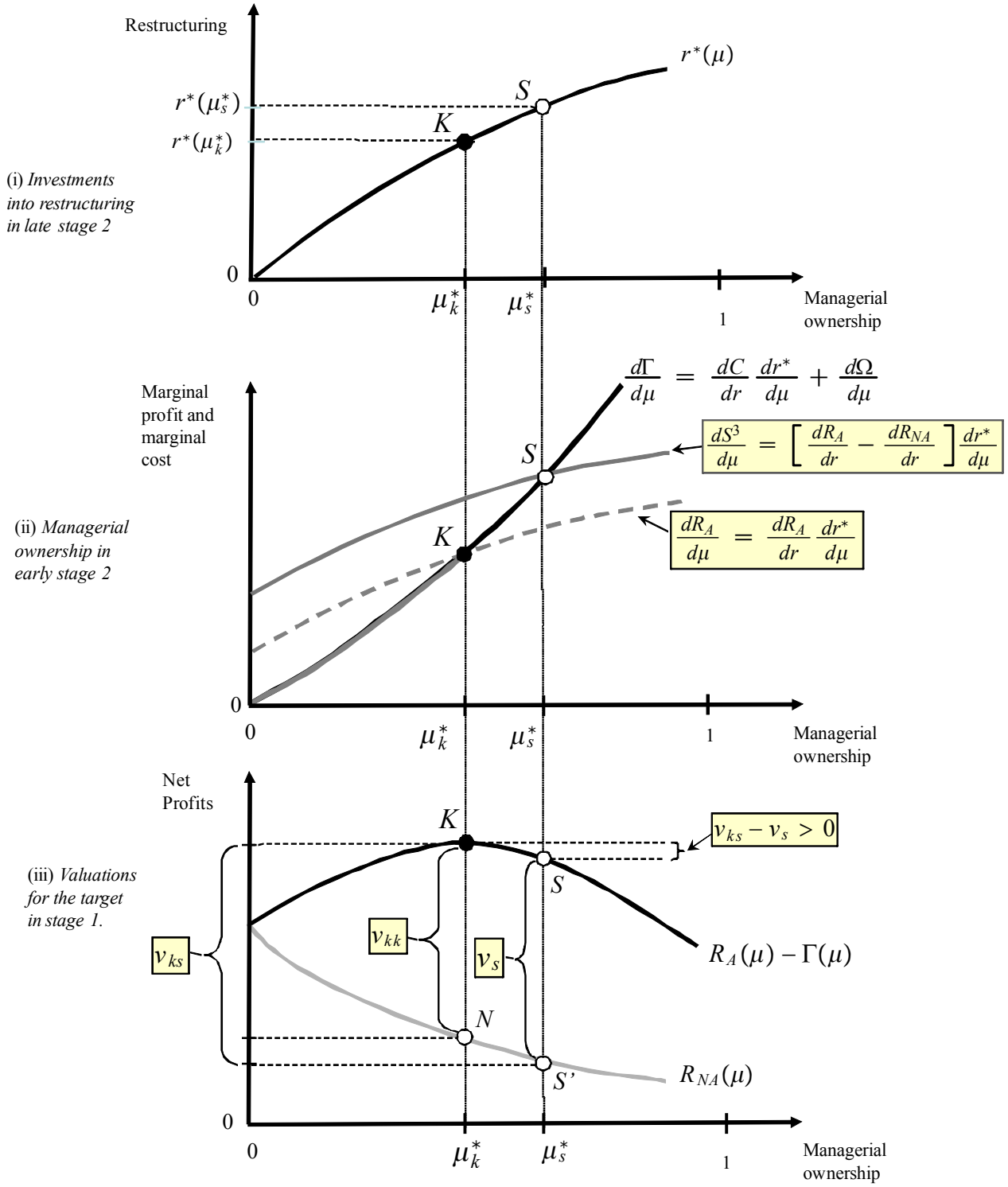

Figure 2.2: Illustrating the intuition. This illustrates the solution to stage one and two of the game. Private equity firms maximizing a trade sale price give stronger incentive contracts to managers. Despite this, private equity firms are not able to outbid incumbents in the initial acquisition auction.

From (2.9), it now follows that the optimal equity share given to the manager is $\mu_k^* = \arg\max_\mu [R_A(\mu) - \Gamma(\mu)]$ with associated first-order condition

$$\frac{dR_A}{dr}\frac{dr^*}{d\mu} = \Gamma'(\mu_k^*). \tag{2.10}$$

The optimal equity share μ_k^* is shown point K in Figure 2.2(ii). Note that $\frac{dR_A}{dr}\frac{dr^*}{d\mu}$ is the marginal revenue from giving more equity to the manager; $\frac{dr^*}{d\mu} > 0$ is the increase in restructuring; whereas $\frac{dR_A}{dr} > 0$ is the increase in profits from increased restructuring. The corresponding marginal cost in terms of higher wage demands from the manager is $\Gamma' = \frac{d\Gamma}{d\mu} = \frac{dC}{dr}\frac{dr^*}{d\mu} + \Omega'(\mu)$, arising from a higher effort cost $\frac{dC}{dr}\frac{dr^*}{d\mu} > 0$ and a higher restructuring risk $\Omega'(\mu) > 0$.

A *buy-to-keep incumbent firm* will thus offer the manager the equity share μ_k^* given from (2.10) combined with the fixed wage b_k^* given from participation constraint $w(b_k^*, \mu_k^*) - C(r^*(\mu_k^*)) - \Omega(\mu_k^*) = \bar{w}$.

2.3.3. The incentive contract offered by a buy-to-sell private equity firm

Suppose instead that a buy-to-sell private equity firm obtained the target in Stage one. A private equity firm will maximize the expected trade sale price $\mathrm{E}[S^3(\mu) - F + \varepsilon - w(b, \mu)]$, where the trade sale price is $S^3(\mu) = R_A(\mu) - R_{NA}(\mu)$ from Lemma 1. Solving the manager's compensation $w(b, \mu) = \bar{w} + C(\mu) + \Omega(\mu)$ from her participation constraint and noting that $\mathrm{E}[\varepsilon] = 0$, it follows that the expected profit for the a private equity firm can be written as

$$\mathrm{E}[S^3(\mu) - F + \varepsilon - w(b, \mu)] = R_A(\mu) - R_{NA}(\mu) - \Gamma(\mu), \tag{2.11}$$

where $\Gamma(\mu) = F + \bar{w} + C(\mu) + \Omega(\mu)$ is again the total restructuring costs.

From (2.11), it follows that the optimal share of profits given to the manager is $\mu_s^* = \arg\max_\mu [R_A(\mu) - R_{NA}(\mu) - \Gamma(\mu)]$ with associated first-order condition:

$$\left[\frac{dR_A}{dr} - \frac{dR_{NA}}{dr}\right]\frac{dr^*}{d\mu} = \Gamma'(\mu_s^*). \tag{2.12}$$

The optimal equity share μ_s^* is given from point S in Figure 2.2(ii). Note that $\left[\frac{dR_A}{dr} - \frac{dR_{NA}}{dr}\right]\frac{dr^*}{d\mu}$ reflects the marginal revenue of giving more equity to the manager; $\frac{dr^*}{d\mu}$ is the increase in restructuring ,whereas $\frac{dS^3}{dr} = \frac{dR_A}{dr} - \frac{dR_{NA}}{dr}$ shows the increase in the trade sale price from more restructuring. The marginal cost in terms of higher compensation is $\Gamma' = \frac{d\Gamma}{d\mu} = \frac{dC}{dr}\frac{dr^*}{d\mu} + \Omega' > 0$.

We conclude that the optimal contract offered by a *buy-to-sell private equity firm* is the equity share μ_s^* given from (2.12) combined with the fixed wage b_s^* from the participation constraint $w(b_s^*, \mu_s^*) - C(\mu_s^*) - \Omega(\mu_s^*) = \bar{w}$.

2.3.4. Why buy-to-sell private equity firms give stronger incentive contracts

Let us now compare the incentive contract given to the manager by a buy-to-sell private equity firm to a contract given to the manager by a buy-to-keep incumbent firm. We state the following proposition.

Proposition 1. *(i) Managers in private equity owned firms have stronger incentive contracts than managers in incumbent owned firms ($\mu_s^* > \mu_k^*$). (ii) More restructuring is undertaken in private equity owned firms ($r^*(\mu_s^*) > r^*(\mu_k^*)$).*

The proof of Proposition 1 follows directly from equations (2.10) and (2.12). To see this, consider Figure 2.2(ii). The marginal cost of increasing the managers equity share, Γ', reflects higher wage compensation from more restructuring effort and higher risk. From (2.5), a buy-to-keep incumbent firm and buy-to-sell private equity firm share this same marginal cost, Γ'. However, the marginal revenue of increasing the equity share is not the same: a buy-to keep incumbent accounts for how equity-induced restructuring increases the product market profits of the firm, the *carrot effect* ($\frac{dR_A}{dr}\frac{dr^*}{d\mu} > 0$); a buy-to-sell private equity firm accounts for how equity-induced restructuring increases the trade sale price, consisting of both the the increase in product market profits of an acquiring incumbent, the above *carrot effect* ($\frac{dR_A}{dr}\frac{dr^*}{d\mu} > 0$), as well as the decrease in the product market profits if an incumbent becomes a non-acquiring incumbent, the "*stick effect*" ($\frac{dR_{NA}}{dr}\frac{dr^*}{d\mu} < 0$).

Comparing equations (2.10) and (2.12), we can see that the stick effect, $\frac{dR_{NA}}{dr}\frac{dr^*}{d\mu} < 0$, implies that a buy-to sell private equity firm always gives the manager a stronger incentive contract, $\mu_s^* > \mu_k^*$. In Figure 2.2(ii) this shown by the point S being located to the right of point K. Since managers in private equity firms have stronger incentive contracts, $\mu_s^* > \mu_k^*$ it follows directly from (2.8) that managers conduct more restructuring in buy-to-sell private equity firms than managers in buy-to-keep incumbent firms, $r^*(\mu_s^*) > r^*(\mu_k^*)$. This is illustrated in Figure 2.2(i).

2.4. Acquisition auction and equilibrium ownership structure (Stage one)

Let us now turn to the initial acquisition auction in Stage one. As in Stage three, the acquisition auction is solved for Nash equilibria in undominated pure strategies. The n incumbents and the m private equity firms simultaneously post bids, which are accepted or rejected by the target. Each incumbent and private equity firm announces a bid, b_i, where $b = (b_1, ..., b_i, ...b_{n+m}) \in R^{n+m}$ is the vector of these bids. Following the announcement of b, the target is sold to the incumbent or the private equity firm with the highest bid. If more than one firm makes an offer of the highest value, each such bidder obtains the target with equal probability.

Let us now turn to the valuations of the target by buy-to-keep incumbents and buy-to sell private equity firms. Since the auction has externalities, the value of winning is determined *in relation to* the value of losing the auction. Define the valuations v_s, v_{kk} and v_{ks} as follows, noting that $\mathrm{E}[\varepsilon] = 0$:

- v_s is the valuation of obtaining the target for a buy-to sell private equity firm. To derive v_s, evaluate the expected profit for a private equity firm in (2.11) at the level of restructuring of manager induced by the optimal equity share μ_s^*:

$$v_s = R_A(\mu_s^*) - R_{NA}(\mu_s^*) - \Gamma(\mu_s^*). \tag{2.13}$$

- v_{kk} is an incumbent's valuation of obtaining the target *if another incumbent would otherwise have obtained it.* Evaluating the expected profit of an incumbent firm in (2.9) and the reduced-form profit for an non-acquiring incumbent at the optimal equity share μ_k^*, we obtain:

$$v_{kk} = R_A(\mu_k^*) - \Gamma(\mu_k^*) - R_{NA}(\mu_k^*). \tag{2.14}$$

- v_{ks} is an incumbent's valuation of obtaining the target *if a private equity firm would otherwise have obtain it, restructured it, and sold it back to the industry.* Thus, evaluating the expected profit of an incumbent firm in (2.9) at the optimal equity share μ_k^* and reduced-form profit for an non-acquiring incumbent at the optimal equity share μ_s^*, we obtain:

$$v_{ks} = R_A(\mu_k^*) - \Gamma(\mu_k^*) - R_{NA}(\mu_s^*). \tag{2.15}$$

These valuations can in general be ranked in six ways. The following lemma solves the auction for all six rankings:

Lemma 2. *The equilibrium ownership of the target firm and the acquisition price S^1 in Stage one is given in Table 2.1.*

Inequality	Definition	Winning type	Acquisition price, S^1
$I1$	$v_{kk} > v_{ks} > v_s$	k	v_{kk}
$I2$	$v_{kk} > v_s > v_{ks}$	k or s	v_{kk}
$I3$	$v_{ks} > v_{kk} > v_s$	k	v_{kk}
$I4$	$v_{ks} > v_s > v_{kk}$	k	v_s
$I5$	$v_s > v_{kk} > v_{ks}$	s	v_s
$I6$	$v_s > v_{ks} > v_{kk}$	s	v_s

Table 2.1: Equilibrium Ownership. This table describes the equilibrium owner type (k or s) and the acquisition price S^1 for each possible ranking of the valuations v.

Proof. See the Appendix. ■

Lemma 2 illustrates the equilibrium ownership structures for any ranking of the valuations. Given equations (2.13), (2.14) and (2.15), we can obtain the following proposition:

Proposition 2. *Despite giving the management stronger incentive contracts and inducing more restructuring, buy-to-sell private equity firms cannot outbid incumbents in equilibrium. The target firm is acquired by a buy-to-keep incumbent firm at the acquisition price $S^1 = v_s$.*

To prove the proposition, first note that with the bidding competition between symmetric buy-to-sell private equity firms, the acquisition price in Stage one cannot be lower than the valuation of private equity firm v_s. Then note that a buy-to-sell private equity firm must have a higher valuation than a buy-to-keep incumbent firm preempting a rival acquisition, $v_s > v_{kk}$. This follows directly from the fact that a private equity firm gives an equity share to the manager which maximizes the net trade sale price, $\mu_s^* = \arg\max_\mu [S^3(\mu) - \Gamma(\mu] = \arg\max_\mu [R_A(\mu) - R_{NA}(\mu) - \Gamma(\mu)]$. This is illustrated in Figure 2.2(iii), where $v_s > v_{kk}$. Figure 2.2(iii) also reveals that a buy-to-keep incumbent firm has an incentive to preempt a buy-to-sell private equity firm, $v_{ks} > v_s$. Formally, we note that $v_{ks} - v_s = R_A(\mu_k^*) - \Gamma(\mu_k^*) - [R_A(\mu_s^*) - \Gamma(\mu_s^*)] > 0$, since $\mu_k^* = \arg\max_\mu [R_A(\mu) - \Gamma(\mu]$. But why does an incumbent want to preempt a buyout? The reason is the aggressive restructuring in Figure 2.2(i) under private equity ownership, $r_s^* = r^*(\mu_s^*) > r_k^* = r^*(\mu_k^*)$. Intuitively, a buy-to-keep incumbent is twilling to pay more than a buy-to-sell

private equity firm in order to prevent the private equity firm from intensively restructuring the firm and selling it back to the industry.

Thus, we have established a ranking of valuations, $v_{ks} > v_s > v_{kk}$. Using Lemma 2, the unique Nash-equilibrium is then the one where a buy-to-sell incumbent to buys the target at the valuation of a buy-to-sell private equity firm $S^1 = v_s$. This is the unique equilibrium since $v_{kk} < v_s$ implies that it is not worthwhile for a rival incumbent to challenge an acquisition at the acquisition price $S^1 = v_s$.

We end this section with a two noteworthy observations.

Private equity firms in equilibrium. For private equity firms to acquire targets in equilibrium, they need some kind of advantage. Lower restructuring costs due to more experience with restructuring is one such advantage. Suppose that F differs between ownership forms: $F_s < F_k$. Then, we have

$$v_{ks} - v_s = [R_A(\mu_k^*) - \Gamma(\mu_k^*)] - [R_A(\mu_k^*) - \Gamma(\mu_k^*)] - [F_k - F_s] \tag{2.16}$$

Note that $v_{ks} > v_s$ only if $F_k - F_s$ is sufficiently large. This difference could be related to the type of assets that are up for sale. The prediction is then that buyouts will be more likely for assets where fixed cost advantages are larger for private equity firms.

Transaction costs. The transaction cost associated with acquisitions and buyouts can be substantial. First, there is the cost of due diligence, identifying and evaluation of target firms. Second, there are legal and administrative costs during the acquisition process. Third, appropriation problems may be severe and measures must be taken to reduce the risk of failure in negotiations.

To capture this, we introduce a transaction cost T associated with an acquisition. This implies that we need to rewrite the valuations in the acquisition auction and in the trade sale auction. Note that with a fixed transaction cost T, the trade sale price in Stage three is $S^3(r) = R_A(r) - R_{NA}(r) - T$. The fixed transaction cost will neither affect the optimal restructuring nor affect the optimal equity share in Stage two. Hence, (2.13)-(2.15) become:

$$v_s = R_A(\mu_s^*) - R_{NA}(\mu_s^*) - \Gamma_s(\mu_s^*) - 2T. \tag{2.17}$$

$$v_{kk} = R_A(\mu_k^*) - \Gamma_k(\mu_k^*) - R_{NA}(\mu_k^*) - T. \tag{2.18}$$

$$v_{ks} = R_A(\mu_k^*) - \Gamma_k(\mu_k^*) - R_{NA}(\mu_s^*) - T. \tag{2.19}$$

where $\Gamma_s(\mu_s^*) = F_s + \bar{w} + C(\mu_s^*) + \Omega(\mu_s^*)$ and $\Gamma_k(\mu_k^*) = F_k + \bar{w} + C(\mu_k^*) + \Omega(\mu_k^*)$. This allows us to state the following proposition.

Proposition 3. *Decreased transaction costs increase the likelihood of private equity buyouts.*

To see this, note that transaction costs impact a buy-to-sell private equity firm twice; first in the acquisition of the target in Stage one and then during the trade sale in Stage three. Differentiate the valuations in the acquisition auction with respect to T to obtain $\frac{dv_s}{dT} = -2 < -1 = \frac{dv_{kk}}{dT} = \frac{dv_{ks}}{dT}$. Hence a reduction of transaction cost will benefit private equity firms more than incumbents. Reduced transactions costs thus increase the possibility that a private equity firm can outbid incumbents in the initial acquisition auction.

3. Extensions

In this section we consider several extensions to our model. In Subsection 3.1 we discuss incentive contracts based on the trade sale price instead of on product market profits, and in Subsection 3.2 we study debt as an incentive mechanism. Subsection 3.3 allows incumbents to also buy assets in order to sell them, and we end this section by discussing private equity firms as temporary owners in Subsection 3.4.

3.1. Incentive contracts based on the trade sale price

In the main analysis, we assumed that the manager was given a share of the reduced product market profits ($R_A(r)$) net restructuring costs. This enables us to compare the intensity of the compensation contract for the two ownership types, given that they both give the same kind of contract to the manager. This is consistent with many contracts used in practice. Managers in private equity owned firms are often required to remain with the target (or are forced to keep their stocks in the firm) post exit in order to reduce problems related to, for example, window dressing. However, if the manager is allowed to sell all shares at the time of exit, the relevant share for the manager is a share of the trade sale price instead of a share of the product market profits.

Suppose that in Stage two the private equity firm gives the manager a contract $\{\mu, b\}$ where the equity share μ now specifies a share of the trade sale price $S^3(r) = R_A(r) - R_{NA}(r)$. The

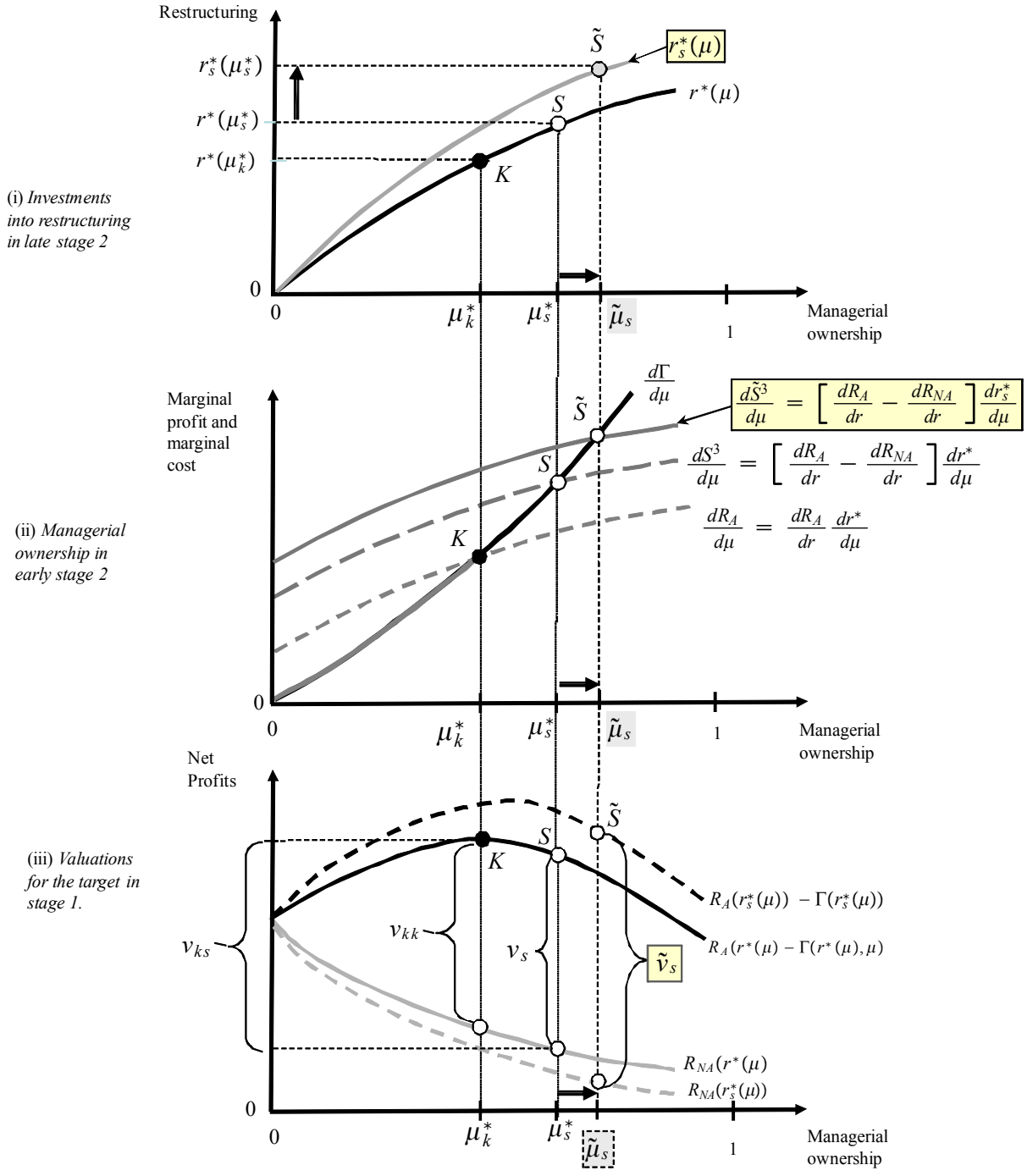

Figure 3.1: Illustrating the intuition. This illustrates the solution for stage one and two of the game when the manager is offered a share of the trade sale price instead of a share of product market profits. The manager then reacts stronger to increased managerial ownership, however it is still optimal for private equity firms to give managers larger ownership shares than what incumbents give their managers.

wage compensation given to the manager is

$$w = b + \mu[R_A(r) - R_{NA}(r) - F + \varepsilon]. \tag{3.1}$$

Working through the managers optimization problem in the beginning of Stage two, we find that the manager's first-order condition when setting the restructuring intensity is

$$\mu \left[\frac{dR_A}{dr} - \frac{dR_{NA}}{dr} \right] = \frac{dC(r_s^*(\mu))}{dr}. \tag{3.2}$$

Under incumbent ownership, managerial compensation in (2.5) is based on a share of the product market profit and the optimal restructuring by the manager is still given from equation (2.7). Comparing (3.2) and (2.7), we note that the "stick-effect ($\frac{dR_{NA}}{dr} < 0$) also implies $r_s^*(\mu) > r^*(\mu)$, that is, a manager in a buy-to-sell private equity firm will restructure more than a manager in a buy-to-keep incumbent for a given equity share μ. This is shown in Figure 3.1(i).

From (3.2) and (2.7), the manager in a buy-to-sell private equity firm will also react more strongly to an increase in the ownership share μ:

$$\frac{dr_s^*}{d\mu} = -\frac{R_A^{'} - R_{NA}^{'}}{\mu[R_A^{''} - R_{NA}^{''}] - C''} > -\frac{R_A^{'}}{\mu R_A^{''} - C''} = \frac{dr^*}{d\mu} > 0. \tag{3.3}$$

where we assume that the second-order conditions $\mu[R_A^{''} - R_{NA}^{''}] - C'' < 0$ and $\mu R_A^{''} - C'' < 0$ are fulfilled, and that $R_A(r)$ and $R_{NA}(r)$ are convex or not too concave. The reason why the manager is also more sensitive to an equity contract in a buy-to-sell firm is once more due to the "stick-effect", $R_{NA}^{'} = dR_{NA}/dr < 0$, increasing the trade sale price.

At the beginning of Stage two, the new owner set the compensation contract for the manager. The optimal ownership share for the incumbent remains unchanged at $\mu_k^* = \arg\max_\mu [R_A(r^*(\mu)) - \Gamma(r^*(\mu), \mu)]$. However, the optimal equity share for a private equity firm is now $\tilde{\mu}_s = \arg\max_\mu [R_A(r_s^*(\mu) - R_A(r_s^*(\mu)) - \Gamma(r_s^*(\mu), \mu)]$ with the first-order condition

$$\left[\frac{dR_A}{dr} - \frac{dR_{NA}}{dr} \right] \frac{dr_s^*}{d\mu} = \Gamma'(\tilde{\mu}_s). \tag{3.4}$$

When the manager receives a share of the trade sale price, there are now two effects causing stronger incentive contracts in private equity owned firms ($\tilde{\mu}_s > \mu_k^*$). Private equity firms have stronger incentives to induce restructuring intensity from the stick effect, $dR_{NA}/dr < 0$. In addition, managers in private equity firms will also respond more strongly to an increase in the equity share $\frac{dr_s^*}{d\mu} > \frac{dr_k^*}{d\mu} > 0$, as shown in (3.3). This is illustrated in Figure 3.1(ii), where

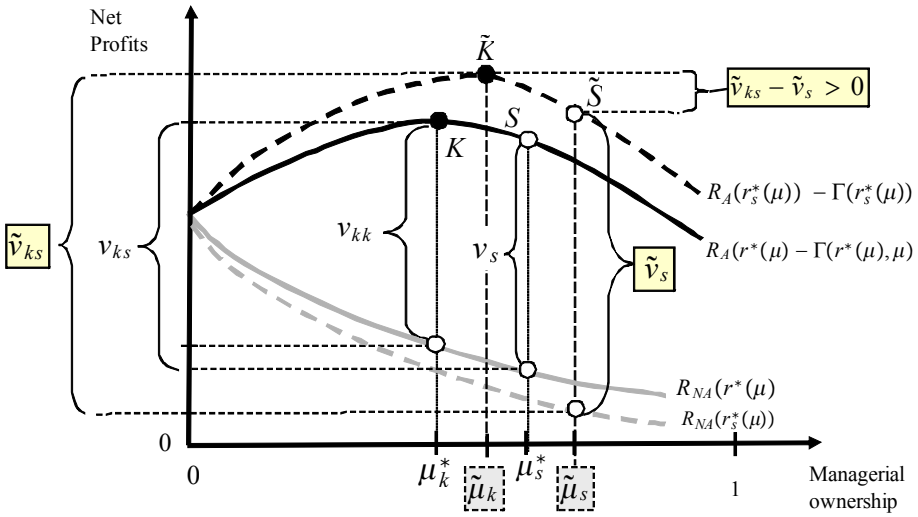

Figure 3.2: Incumbents copying the contract private equity firms give. This illustrates the solution to Stage one when an incumbent offers the manager a "relative compensation contract" that mimics the contract a private equity firm offers. Even then, private equity firms use more intense compensation contracts and can not outbid incumbents.

$\tilde{\mu}_s > \mu_k^*$. Inspecting Figures 3.1(i)-(ii) we note that Proposition 1 remains true also in a setting where private equity firms base incentive contracts on the trade sale price.

Let us end with a final remark on the equilibrium ownership structure determined in Stage one. As shown in Figure 3.1(iii), applying the equity share for the manager on the trade sale price rather than on the product market profits, private equity firms can increase their valuation, since $\tilde{v}_s = R_A(r_s^*(\tilde{\mu}_s)) - R_{NA}(r_s^*(\tilde{\mu}_s)) - \Gamma(r_s^*(\tilde{\mu}_s), \tilde{\mu}_s) > v_s = R_A(r^*(\mu_s^*)) - R_{NA}(r^*(\mu_s^*)) - \Gamma(r^*(\mu_s^*), \mu_s^*))$ holds from $r_s^*(\mu) > r^*(\mu)$.[9] Competition between private equity firms will then induce such a contract. As also shown in this Figure, private equity firms can then even outbid incumbents, $\tilde{v}_s > v_{ks}$.

Would an incumbent have incentives to then also construct a compensation contract similar to the private equity firm's compensation contract? Yes. In fact, giving the same wage compensation as in (3.1), incumbent firms will outbid private equity firm when applying the optimal equity share. This follows since $\tilde{\mu}_k = \arg\max_\mu [R_A(r_s^*(\mu)) - \Gamma(r_s^*(\mu), \mu)] < \tilde{\mu}_s^* = \arg\max_\mu [R_A(r_s^*(\mu) - R_A(r_s^*(\mu)) - \Gamma(r_k^*(\mu), \mu)]$, $\tilde{v}_{ks} = R_A(r_s^*(\tilde{\mu}_k)) - \Gamma(r_s^*(\tilde{\mu}_k), \tilde{\mu}_k) - R_{NA}(r_s^*(\tilde{\mu}_s))$

[9] We are then assuming that $R_A(r_s^*(\mu)) - \Gamma(r_s^*(\mu), \mu) > R_A(r^*(\mu)) - \Gamma(r^*(\mu), \mu)$, from $r_s^*(\mu) > r^*(\mu)$, i.e. that the net profit of the acquirer increases from having the manager providing more restructuring.

and $\tilde{v}_{ks} - \tilde{v}_s = R_A(r_s^*(\tilde{\mu}_k)) - \Gamma(r_s^*(\tilde{\mu}_k), \tilde{\mu}_k) - [R_A(r_s^*(\mu_s^*)) - \Gamma(r_s^*(\mu_s^*), \mu_s^*)] > 0$. Thus, as shown in Figure 3.2, Proposition 2 also holds in a setting where private equity firms define the manager's ownership share on the trade sale price and where incumbents replicate such a contract.

3.2. Using debt to induce effort

Debt can also work as an incentive device if debt forces the manager to work harder to avoid bankruptcy (see e.g. Jensen and Meckling (1976) and Jensen (1989)). When deciding on leverage, the owners trade off increased restructuring efforts against increased probability of bankruptcy.

Formally, at the beginning of Stage two, the owner of the target decides how much debt, D, to acquire and then hires a manager to undertake restructuring to increase r. The probability of surviving the restructuring Stage is $\rho(r, D) \in [0, 1]$, $\rho'_r(r, D) > 0$, $\rho''_{rr}(r, D) < 0$, $\rho'_D(r, D) < 0$ and $\rho''_{rD}(r, D) > 0$. If the firm goes bankrupt during restructuring (with probability $1 - \rho(r, D)$), profits are zero.

The manager receives a fixed wage b if the firm survives and zero wage otherwise. The effort cost of r to the manager is once more $C(r)$ with $C'(r) > 0$ and $C''(r) > 0$, but the manager is no longer risk averse. Formally, given debt D, the manager sets r to maximize $\rho(r, D)b - C(r)$, where optimal restructuring is implicitly determined by

$$\rho'_r(r^*, D)b = C'(r^*), \tag{3.5}$$

with the associated second-order condition $\rho''_{rr}b - C''(k) < 0$. The manager's restructuring effort r^* is increasing in the amount of debt the firm takes on: $\frac{dr^*}{dD} = -\frac{\rho''_{rD}b}{\rho_{rr}b - C''} > 0$.

An incumbent maximizes the expected profit net of interest payments on debt (paid upon successful restructuring), $\rho(r^*(D))[R_A(r^*(D)) - b - iD]$, where i is the interest rate. Optimal debt for an incumbent firm is implicitly determined by the first-order condition

$$\underbrace{\frac{d\rho}{dD}\left[R_A - iD_k^*\right]}_{\text{Marginal cost of increased bankruptcy probability}} + \underbrace{\rho\left[\frac{dR_A}{dr^*}\frac{dr^*}{dD} - i\right]}_{\text{Marginal benefit of increased restructuring}} = 0, \tag{3.6}$$

where $\frac{d\rho}{dD} = \rho'_r\frac{dr^*}{dD} + \rho'_D$ is the total derivative of debt on the probability of survival. We assume the second-order condition holds.

A private equity firm maximizes the expected trade sale price net of interest payments on debt, $\rho(r^*(D))[S^3(r^*(D)) - b - iD]$. The optimal amount of debt for a private equity owned firm is given from the first-order condition:

$$\frac{d\rho}{dD}\left[S^3 - rD_s^*\right] + \rho\left[\frac{dS^*}{dr^*}\frac{dr^*}{dD} - i\right] = 0. \tag{3.7}$$

Rewrite (3.7) as:

$$\underbrace{\frac{d\rho}{dD}\left[R_A - iD_s^*\right] + \rho\left[\frac{dR_A}{dr^*}\frac{dr^*}{dD} - i\right]}_{\text{First-order condition for an incumbent}} + \underbrace{\left[-\rho\frac{dR_{NA}}{dr^*}\frac{dr^*}{dD} - \frac{d\rho}{dD}R_{NA}\right]}_{\text{Marginal effect on a non-acquirer (positive)}} = 0. \tag{3.8}$$

A comparison of (3.6) and (3.8) shows that a private equity owned firm will take on more leverage than an incumbent owned firm, i.e. $D_s^* > D_k^*$. The intuition is now familiar. A private equity firm maximizes the expected trade sale price, $\rho(r^*(D))[S^3(r^*(D)) - b - ir^*(D)]$ rather than the expected reduced product market profits, $\rho(r^*(D))[R_A(r^*(D)) - b - ir^*(D)]$. If debt is taken on to induce a manager to put more effort into restructuring, then owners buying to sell optimally choose higher leverage than owners buying to keep.[10]

3.3. Incumbents buying to sell

A central assumption in our model is that incumbents buy assets to keep them, whereas private equity firms buy to sell. Would our results still hold if incumbents could imitate private equity firms and also buy to sell?

Suppose that incumbent firm has acquired the target in Stage one and that the incumbent attempts to sell the restructured assets to a competitor. From Lemma 1, we know that the trade sale price in Stage three is $S^3(r) = R_A(r) - R_{NA}(r)$. We also know the profits from competing with a rival who possesses the assets are $R_{NA}(r)$. Thus, the total profits from selling the assets and remaining in the industry would be $S^3(r)+R_{NA}(r)$. Working through the contract for a hired manager in Stage two, we note that the expected profit an incumbent mimicking a buy-to-sell firm is the exactly the same as in (2.9):

$$\mathrm{E}[S^3(\mu) - F + \varepsilon - w(b,\mu) + R_{NA}(\mu)] = R_A(\mu) - \Gamma(\mu). \tag{3.9}$$

From (3.9) it is clear that an incumbent acting as a buy-to-sell firm gives the same optimal contract as a buy-to-keep incumbent firm, $\{\mu_k^*, b_k^*\}$. But then, propositions 1 and 2 still hold; If the acquiring incumbent sells the restructured assets to a rival and remains in the market without the assets, private equity firms give stronger incentive contracts which induce (other)

[10] Recall that to highlight how incentive problems affect restructuring, we have assumed that incentive problems are only present during restructuring (stage two), not in the product market interaction stage (stage four).

incumbents to outbid private equity firms in equilibrium. The key to why the incumbent does not become as aggressive as the private equity firm is that the incumbent internalizes the effect on its other asset holdings when setting the compensation contract to determine restructuring intensity.

But cannot the incumbent sell all its assets and completely exit the industry? This is possible, but if it is profitable or not will depend on the classical merger profitability condition (Salant et al., 1983). In our setting, exit occurs if the following condition holds:

$$\underbrace{R_A(\mu_s^*; n-1) - R_{NA}(\mu_s^*; n-1) - \Gamma(\mu_s^*)}_{\text{Profits from selling (with concentration effect), } v_s} > \underbrace{R_A(\mu_k^*; n) - \Gamma(\mu_k^*)}_{\text{Profits from keeping}}, \tag{3.10}$$

where we note that an exits leads to a concentration of the market since there are then $n-1$ incumbents remaining.

In general, the sign of equation (3.10) depends on merger and market-specific characteristics such as level of concentration in the market and asset complementaries. If the asset complementaries are sufficiently low, and the market power increase caused by the merger is sufficiently low, the incumbent will not have the incentives to completely exit the industry. Studying this in detail is, however, outside the scope of this paper.

3.4. Private equity firms as temporary owners

Our main analysis took the empirical observation that private equity firm exit their investments after a predefined time period as the starting point. We then argued that this feature gives private equity firms different incentives to restructure targets compared to incumbents. But what are the reasons for a temporary ownership of corporate assets? Fully analyzing this issue is outside the scope of this paper, but we conjecture that it could be because private equity firms are fundamentally outside the industry as compared to incumbents who already possess industry-specific assets. Being outside the market would cause private equity firms to invest more in restructuring skills than in ongoing management skills as compared to incumbent owners and managers. If these restructuring skills are only needed for a specific limited time period, there is likely to exist an equilibrium where some owners and managers specialize in restructuring while others specialize in the general management skills needed to run a firm in the long run. Private equity firms then have incentives to exit their investments and look for new restructuring opportunities once they are done with the assets they currently hold. As Muscarella and Vet-

suypens (1990) note "Exit strategies are important because LBO specialists' unique expertise lies in their ability to oversee the efficient restructuring of operations. Once such restructuring is largely accomplished in a given firm, the LBO specialist's marginal productivity will be higher if it redeploys capital and efforts elsewhere." Formal analysis of these issues is outside the scope of this paper but is a promising avenue for further research.

4. Empirical implications

In this section, we collect a set of empirical implications of our model and relate them to available empirical evidence.

4.1. Incentive contracts

Proposition 1 states that managers in private equity owned firms will be given more high powered incentive contracts than managers in incumbent owned firms, i.e. $\mu_s^* > \mu_k^*$.

Consequently, we can directly state that

Prediction 1: *Managers in private equity owned firms have stronger incentive contracts than managers in incumbent firms.*

This prediction is consistent with existing evidence. Kaplan (1989); Jensen and Murphy (1990); Kaplan and Strömberg (2009); Leslie and Oyer (2008) and Acharya and Kehoe (2008) find that targets owned by private equity firms have managers with stronger incentive contracts and a larger ownership share in the firm.

4.2. Productivity

Proposition 1 also states that more restructuring is undertaken in private equity owned firms than in incumbent firms, $r^*(\mu_s^*) > r^*(\mu_k^*)$. This "overinvestment" in restructuring implies that the total profits (including managerial compensation) are lower if the target is private equity owned, $R_A(\mu_s^*) - \Gamma_s(\mu_s^*) < R_A(\mu_s^*) - \Gamma_s(\mu_s^*)$ but that product market profits higher, $R_A(\mu_s^*) > R_A(\mu_k^*)$, and (implied) productivity is higher.

Prediction 2: *Private equity owned firms undertake more restructuring than incumbent firms, which leads to higher product market profits and higher productivity, but lower total profits net the acquisition price.*

This prediction is also consistent with existing evidence on buyouts. Lichtenberg and Siegel (1990); Amess (2002, 2003); Harris et al. (2005) and Cumming et al. (2007) find evidence of a buyout increasing the productivity of the target firm.

Our model shows that private equity owned firms will invest beyond the level that would maximize an incumbent's profits. This higher level of investment explains that targets restructured by private equity firms have better long-run operational performance than incumbents. However, the net profit of the acquirer (including the acquisition price) will be lower in industries where private equity is present compared to industries with no private equity firms, since the acquisition price of the target will be higher. To see this, note that the difference net profit of the acquirer in an industry with private equity firms and an industry without private equity firms is

$$R_A(\mu_k^*) - \Gamma_s(\mu_k^*) - \underbrace{v_s}_{S^1=v_s} - [R_A(\mu_k^*) - \Gamma_s(\mu_k^*) - \underbrace{v_{kk}}_{S^1=v_{kk}}] = v_{kk} - v_s < 0.$$

4.3. Leverage

In section 3.2, we derived a prediction on leverage by replacing managerial ownership with debt as a way of inducing managerial effort (see e.g. Jensen [1986]).As previously, private equity firms buying to sell have incentives to induce more restructuring effort due to previously identified "stick-effect" on the trade sale price.

Prediction 3: *To induce managers to undertake more restructuring, private equity firms leverage their targets more than incumbent firms.*

Evidence on this is found in e.g. Axelsson et al. (2008) or Leslie and Oyer (2008).

4.4. Transaction costs

Proposition 3 suggests that factors such as financial market development that decrease the transaction costs of acquisitions should increase the share of private equity buyouts in relation to incumbent acquisitions, since transaction costs are incurred twice by private equity firms. Thus, we can state the following prediction:

Prediction 4: *The share of private equity buyouts to incumbent acquisitions increases when the transaction cost decreases.*

To our knowledge, there exists no systematic econometric work on how the share of private equity buyouts to incumbent acquisitions depends on the level of transaction costs.

4.5. Exit route

We can modify our model to derive predictions on the mode of exit. Suppose that the private equity firm can choose between a trade sale or an IPO—an IPO implying that the target is placed back on the market as a separate firm and at an IPO cost. For high IPO costs, or if the restructuring costs are not too convex, the preferred exit mode will then be a trade sale. The reason is that revenues through the trade sale price increase both through the carrot effect the stick effect, while the revenues of an IPO are only affected by the carrot effect. Hence, the trade sale valuation increases faster in restructuring than the IPO valuation. If restructuring costs are not too convex (making restructuring very costly), the trade sale price will exceed the IPO valuation and thus the optimal exit mode is an IPO. For proof, see Appendix A.3.

Prediction 5: *The optimal exit mode is a trade sale if IPO costs are high, or if restructuring costs are not too convex.*

Moreover, the fact that the trade sale price is more sensitive to restructuring than the IPO valuation has implications on the characteristics of targets that will exit through a trade sale. First, firms that exited through a trade sale should be more restructured and should therefore have higher product market profits and productivity. Second, if a target is hit by a negative cost shock (e.g. an accepted patent) or a positive demand shock (e.g. increased demand for their product), it has the same effect as increased restructuring on exit mode incentives and will therefore lead to a higher probability of a trade sale.

Prediction 6: *Targets exited through a trade sale rather than through IPOs should be associated with higher productivity and product market profits. Further, targets owned by private equity firms that are hit by a negative cost shock or a positive demand shock are more likely to be exited through a trade sale than an IPO.*

To our knowledge, there is no systematic econometric work done on how the exit mode for private equity depends on IPO costs, on restructuring costs, and on cost and demand shocks. However, Lerner (1994) and Brau et al. (2003) find that for venture capital exits, market timing is of importance as regards exit type.

5. Concluding remarks

In this paper we develop a theory of buyouts that incorporates temporary ownership, agency problems, and oligopolistic competition. Our model can explain the empirical fact that private equity owned firms have more leverage and managers with more intense compensation contracts than comparable public firms. The key insight is that buying to sell makes private equity firms more aggressive in giving managers incentives to exert effort, since the trade sale price increases not only through the increased value of possessing the assets, but also through the increased value of preventing a rival from obtaining the assets. Moreover, our theory suggests that reduction in transaction costs can explain why private equity ownership has increased over the last decades. The reason being that private equity firms are owners that buy to sell and therefore are more affected by reduced transaction costs.

We believe there are other market situations where owners buying to sell have fundamentally different incentives than owners buying to keep. To see this, suppose an owner (who is buying to keep or buying to sell) undertakes an investment, δ, in an asset. Both owner types face the same investment costs $c(\delta)$. The investment leads to a discounted stream of profits for the eventual owner of the asset. It then follows that as long as the marginal effect on the sale price, $S'(\delta)$, equals the marginal effect on the long-run value, $V'(\delta)$, the owner buying to sell and the owner buying to keep will undertake the same investment ($\delta_s = \delta_k$). But as shown in the above analysis, if there are oligopolistic externalities on the trade sale price (the "stick effect") it holds that $S'(\delta) > V'(\delta)$ and the owner buying to sell will invest more ($\delta_s > \delta_k$).

Several other market situations may cause buy to sell owners to have different investment incentives than buy to keep owners. For example, appropriability problems in connection with the sale may affect investment in patents. An owner buying to keep may prefer to keep most of its important innovations as trade secrets, whereas an owner buying to sell must patent them to keep potential buyers from stealing the secrets. Reputation may also be of importance. Owners buying to sell may have to repeatedly raise funds from outside investors for their investments. For these investors, the exit sends a signal about the quality of the owner. A good signal makes it easier to raise the next fund, which implies that owners buying to sell have additional incentives to perform well. This affects the sale price $S(\delta)$, but not the long-run value $V(\delta)$. Examining these different issues related to temporary ownership in detail is an exciting avenue for future research.

A. Appendix

A.1. Proof of Lemma 1

Consider the equilibrium candidate $b^* = (b_1^*, b_2^*, ..., b_n^*)$. Incumbent f is the incumbent that has posted the highest bid and obtains the restructured target and firm s is the incumbent with the second highest bid. Then, $b_f^* \geq \omega_{kk}$ is a weakly dominated strategy. $b_f^* < \omega_{kk} - \varepsilon$ is not an equilibrium, since firm $i \neq f$ then benefits from deviating to $b_i = b_f^* + \varepsilon$, since it will then obtain the restructured target and pay a price lower than its valuation of obtaining it. If $b_f^* = \omega_{kk} - \varepsilon$, and $b_s^* \in [\omega_{kk} - \varepsilon, S - 2\varepsilon]$, then no incumbent has an incentive to deviate, b^* is a Nash equilibrium and the winning bid is $b_f^* = \omega_{kk} - \varepsilon$.

A.2. Proof of Lemma 2

First note that $b_i \geq \max\{v_s, v_{kk}, v_{ks}\}$ is a weakly dominated strategy. No owner wants to post a bid above its valuation of obtaining the assets and the assets will always be sold.

Inequality I1 ($v_{kk} > v_{ks} > v_s$): Since $v_{ks} > v_s$, a buy-to-keep owner will always have an incentive to outbid buy-to-sell owners. The buy-to-keep owners will then bid up the price to v_{kk} to prevent a rival from obtaining the assets. A buy-to-keep owner will obtain the assets.

Inequality I2 ($v_{kk} > v_s > v_{ks}$): Since $v_s > v_{ks}$, the outcome depends on what a buy-to-keep owner believes will happen if it does not win. If it believes that another buy-to-keep owner will win, buy-to-keep owners will then bid up the price to v_{kk} and a buy-to-keep owner will obtain the assets. If it believes that a buy-to-sell owner will win, then since $v_s > v_{ks}$ the buy-to-sell owners will bid up the price to v_s and a buy-to-keep owner will obtain the assets.

Inequality I3 ($v_{ks} > v_{kk} > v_s$): Since $v_{ks} > v_s$, a buy-to-keep owner will always have an incentive to outbid buy-to-sell owners. The buy-to-keep owners will then bid up the price to v_{kk} to prevent a rival from obtaining the assets. A buy-to-keep owner will obtain the assets. Note that since buy-to-keep owners realize that a buy-to-sell owner will never obtain the assets ($v_{ks} > v_s$), the price will not be bid up to v_{ks}.

Inequality I4 ($v_{ks} > v_s > v_{kk}$): Since $v_{ks} > v_s$, a buy-to-keep owner will always have an incentive to outbid buy-to-sell owners and bid up the price to slightly above v_s. However, only one buy-to-keep owner has this incentive, since no other buy-to-keep owner wants to outbid him or her ($v_s > v_{kk}$). A buy-to-keep owner will then obtain the assets at price v_s.

Inequality I5 ($v_s > v_{kk} > v_{ks}$): Since $v_s > v_{ks}$, no buy-to-keep owners will want to outbid

the buy-to-sell owners. The buy-to-sell owners will then bid up the price to v_s and a buy-to-sell owner will obtain the assets.

Inequality I6 ($v_s > v_{ks} > v_{kk}$): Since $v_s > v_{ks}$, no buy-to-keep owners will want to outbid the buy-to-sell owners. The buy-to-sell owners will then bid up the price to v_s and a buy-to-sell owner will obtain the assets.

A.3. The mode of exit: IPO or trade sale?

In our main analysis, a private equity firm sold the target to an incumbent after restructuring. This implies it has strong incentives to induce managers to exert effort due to strategic product market effects on the trade sale price. In this section, we relax the assumption that the private equity firm always exits through a trade sale and sketch a formal analysis also allowing for exit through an IPO (at IPO cost F_{IPO}). This allows us to get a prediction of the mode of exit. Private equity firms tend to exit through a trade sale instead of an IPO when IPO costs are high and restructuring costs are not too convex.

In what follows, we simplify by assuming that the owners can directly set r at a cost $C(r)$; we thereby sidestep hiring a manager to undertake restructuring. If a buyout occurs, we need to determine three things: an incumbents' valuation of obtaining the target if another incumbent would otherwise have obtained it, the incumbents' valuations of obtaining the target if it would otherwise be placed on the market through an IPO; and the valuation of the private equity firm undergoing an IPO.

An incumbent's valuation of obtaining the restructured target if it would otherwise be obtained by another incumbent is

$$\omega_{kk} = R_A(r; n) - R_{NA}(r; n). \tag{A.1}$$

The incumbents' preemptive IPO valuation is defined as

$$\omega_{kIPO} = R_A(r; n) - R_{NA}(r; n+1), \tag{A.2}$$

which is the valuation of acquiring the restructured target if the private equity firm would otherwise exit its investment through an IPO. Note that an additional firm is on the market if an IPO occurs.

Finally, the private equity firm's IPO valuation is

$$\omega_{IPO} = R_E(r; n+1) - F_{IPO},$$

where the first term is simply the product market profits of the target with one more firm on the market and the second term is the costs of undergoing an IPO. The ownership of the restructured target and the trade sale/IPO price can be described by Table A.1 (proof available upon request).

Inequality:	Definition:	Exit route	Trade sale price/IPO revenues
$I1:$	$\omega_{IPO} > \max\{\omega_{kIPO}, \omega_{kk}\}$	IPO	ω^*_{IPO}
$I2:$	$\omega_{kIPO} > \omega_{IPO} > \omega_{kk}$	Trade Sale	ω^*_{IPO}
$I3:$	$\omega_{kk} > \omega_{IPO} > \omega_{kIPO}$	Trade Sale	ω^*_{kk}
$I4:$	$\max\{\omega_{kIPO}, \omega_{kk}\} > \omega_{IPO}$	Trade Sale	ω^*_{kk}

Table A.1: Equilibrium exit route. This table describes the exit route (IPO or trade sale) and the trade sale price/IPO revenues for any possible ranking of the valuations ω.

We can note that in $I3$ and $I4$, the private equity firm exits through a trade sale at the trade sale price ω^*_{kk}. A high IPO cost, F_{IPO}, ensures that we end up in these regions. But, so does also a not "too" convex restructuring cost function. To see this, note that $R_{NA}(r;n)$ and $R_{NA}(r;n+1)$ are decreasing in r. This implies that $\omega_{kk}(r)$ and $\omega_{kIPO}(r)$ increase faster in r than $w_{IPO}(r)$. Then, as we increase r, it is more likely that inequalities $I3$ and $I4$ hold. If the restructuring costs $C(r)$ are not too convex, it can be shown that $r^*_s \in \arg\max_r[\omega_{kk}(r) - C(r)]$ will be substantially larger than $r^{IPO}_s \in \arg\max_r[R_E(r;n+1) - C(r) - F_{IPO}]$ and this implies that inequalities $I3$ and $I4$ are more likely to hold. The optimal exit mode is a trade sale.

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