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BUYING TO SELL: PRIVATE EQUITY BUYOUTS AND INDUSTRIAL RESTRUCTURING

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ABSTRACT

Buying to Sell: Private Equity Buyouts and Industrial Restructuring*

We investigate how temporary ownership by private equity firms affects industry structure, competition and welfare. Temporary ownership leads to strong investment incentives because equilibrium resale prices are determined partly by buyers' incentives to block rivals from obtaining assets. These strong incentives benefit consumers, but harm rivals in the industry. Evaluating optimal antitrust policy, we point out that an active private equity market can aid antitrust authorities by triggering welfare enhancing mergers and by preventing concentration in the industry. By spreading costs of specializing in restructuring over multiple markets, private equity firms have stronger incentives than incumbents to invest in acquiring specialized restructuring skills.

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"Selling a company is like going 'all in' in a game of poker: a single final decision that will irrevocably determine the value of the investment."

-Frankel (2005)

1 Introduction

During the last two decades, acquisitions and resales of large firms by private equity funds have become more prevalent. Strömberg (2008) estimates that the value of all private equity buyouts between 1970 and 2000 was $0.9 trillion, while the value between 2000 and 2007 was close to $2.7 trillion. During the period 1985 to 2006, private equity firms have bought corporate assets in the U.S. yearly at an average value of approximately 1% of the total U.S. stock market value, with a top value of 3% in 2006 (Kaplan and Strömberg (2009)).

Temporary ownership is a defining characteristic of private equity firms. The funds they raise have a limited time span. This means that the median holding period of a company in a private equity fund is only around six years (Kaplan and Strömberg (2009)). As our introductory quote underscores, the payoff from accounting for strategic effects when the time comes to resell the firms they have acquired can potentially be large. Kovenock and Phillips (1995) find evidence that firms with low productivity in concentrated markets are more likely to be acquired by a private equity firm and Hsu, Reed, and Rocholl (2010) present evidence that rivals to private equity backed firms experience decreases in profits following the acquisition.[1] Yet, despite the spread of the private equity ownership form, there is little theoretical work on the effects of temporary ownership on competition, industry structure and total welfare.

In this paper, we develop a theory of temporary ownership in oligopolistic markets. The theory is useful for understanding the welfare effects of an active private equity market and for guiding antitrust policy in response to buyouts and exits by private equity firms. We propose an auction-investment-oligopoly model. One firm (the target) has assets in need of restructuring and puts itself up for sale. Rival incumbents (permanent owners) and private equity firms (temporary owners) bid for the target. Post-acquisition, if the target's assets are sold, the new owner implements a governance structure to induce a manager to restructure the target. If the owner is a private equity firm, the target is put up for sale after being restructured. The bidders are rival incumbents, but the private equity firm also has the option of placing the restructured target on the market as a separate entity by undertaking an initial public offering (IPO).

Our model underscores three properties of temporary ownership. First, temporary ownership leads to *overinvestment* relative to permanent ownership because temporary owners maximize the trade sale

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[1] Moreover, studying retail markets, Chevalier (1995a) and Chevalier (1995b) show that buyouts lead to softer product market competition in the industry if rivals are highly leveraged but that product market competition intensifies when rivals are less leveraged (suggesting that less leveraged rivals can afford to prey on highly leveraged buyout targets to force them to exit the industry).

price from the resale auction rather than simply product market profits. The equilibrium resale price consists of an incumbent's product market profits from owning the target *relative to* the profits if the target is obtained by a rival incumbent. The equilibrium resale price is more sensitive to investments in governance and restructuring than product market profits are, so temporary owners implement stronger governance structures and undertake more restructuring compared to permanent owners. This provides a novel demand side explanation for why empirical studies have consistently found that private equity backed firms are more productive, have managers with more intense compensation contracts, are more leveraged, and why leverage returns to normal after the resale.[2]

In terms of welfare, we show that overinvestment is beneficial for consumers as prices fall but that it hurts rival firms who see their margins deteriorate. When private equity firms acquire targets in need of substantial restructuring (such that the ex-post market share or price-cost margin is relatively low), the negative effect on rivals outweighs the positive effects on consumer surplus and total surplus declines. But when private equity firms acquire good targets and make them great (such that the ex-post market share or price-cost margin is relatively high), the consumer surplus effect outweighs the negative effect on rivals and total surplus increases. Intuitively, the negative effect on total surplus is greater when the ex-post market share or price-cost margin is lower because then the private equity backed firm steals profits from *more* efficient rivals, while when the ex-post market share or price-cost margin is higher the private equity backed firm steals profits from *less* efficient rivals. This effect is reminiscent of what goes on in Mankiw and Whinston (1986). They point out that if entry into an industry causes incumbents to reduce output, then entry can be privately but not socially optimal. In our setting, it is the investments in governance and restructuring that can be privately but not socially optimal because of effects on rivals in the industry. Other settings in which total surplus is likely to increase includes when the market is more concentrated (there are less rivals to steal profits from) and when substantial opportunities for improving governance and undertaking restructuring exist (the costs of these improvements are relatively low which implies that the ex-post market share or price-cost margin will be high).

The second property we underscore is that temporary owners can aid antitrust authorities in maximizing consumer surplus.[3] In the presence of a sufficiently foresighted antitrust authority, the development of an active private equity market is beneficial to consumers for two reasons (in addition to the overinvestment effect). The first reason is that an active private equity market can *trigger mergers* in a merger stable industry. As pointed out by Salant, Switzer, and Reynolds (1983), consumer surplus enhancing or welfare enhancing mergers in an oligopoly may not be privately profitable which presents antitrust au-

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[2]On productivity, see Amess (2003), Harris, Siegel, and Wright (2005) and Davis, Haltiwanger, Jarmin, Lerner, and Miranda (2009). On compensation and leverage, see Kaplan (1989), Leslie and Oyer (2009) and Axelson, Jenkinson, Strömberg, and Weisbach (2010).

[3]Antitrust authorities often intervene in mergers and acquisitions involving private equity firms. For example, in October 2011 a federal judge in the US blocked H&R Block from acquiring 2nd Story Software (owned by the private equity firm TA Associates). The Justice Department argued that the merger would harm competition in the market for digital tax preparation services which is dominated by only three players (H&R Block, 2nd Story Software and Intuit). For more, see the New York Times Dealbook story at http://dealbook.nytimes.com/2011/11/01/judge-scuttles-hr-block-deal/.

thorities with a problem since they cannot force firms to merge. We show that introducing private equity firms as bidders in the first acquisition auction changes the bidding behavior of incumbents because they now have incentives to outbid private equity firms to prevent overinvestment. Thus, the mere threat of a buyout acts as a trigger for previously privately unprofitable mergers. If an antitrust authority can prevent mergers that reduce consumer surplus, all mergers triggered by an active private equity market beneficial for consumers. The second reason an active private equity market can benefit consumers is by *preventing concentration* in the industry. An antitrust authority may desire to block an incumbent acquisition in the initial acquisition auction because of concerns of an increase in concentration in the industry. But blocking acquisitions comes at the cost of forgoing governance improvements and restructuring in the target. In the presence of an active private equity market, the antitrust authority can instead allow a private equity buyout and ensure that the resale auction leads to an IPO by blocking trade sales. This prevents a concentration in the industry while still ensuring that the target's assets are restructured. But because overinvestment incentives are weaker under IPOs than under trade sales, this blocking trade sales is desirable only if preserving competition is more beneficial to consumers than overinvestment.

The third property of temporary ownership we underscore is that temporary ownership drives incentives for *specialization* in restructuring. By spreading costs of specializing in restructuring over multiple markets, private equity firms have stronger incentives than incumbents to invest in acquiring restructuring skills. Specialized restructuring skills help private equity firms outbid incumbents wanting to preemptively acquire the target to prevent overinvestment in governance and restructuring and ensures that an active private equity market emerges in equilibrium.

We have organized the paper as follows. The next section discusses our contribution to the literature. In section 3, we set up and solve the model by considering trade sales as the exit route and discuss the welfare implications of temporary ownership in section 4. In section 5, we generalize the model to allow for IPOs. In section 4, we discuss antitrust policy in the presence of temporary owners and in section 7 we discuss specialization in restructuring. We conclude in section 8. The Appendix contains proofs and extensions relaxing some of our main assumptions. Extensions include allowing incumbents to resell assets and allowing non-acquirers to invest in restructuring.

2   Contribution to the literature

Our main contribution is introducing private equity firms to the industrial organization literature by developing an auction-investment-auction model with endogenous mergers and pre/post-merger investments. The traditional literature on exogenous mergers has focused on how mergers affect prices, profits

and welfare but it has ignored the effects of owner asymmetries and pre/post merger investments.[4] Recently, a literature on endogenous mergers has emerged in which the central question is who merges with whom.[5] A part of this literature has studied pre-merger investments and auctions with externalities.[6] Closest in spirit to our paper is Norbäck and Persson (2009), who develops an auction-investment-auction model with overinvestment aimed at studying how venture capital firms help entrepreneurs develop an innovation for a market. We extend their paper by allowing for resales to different owner types (incumbents or outsiders), by conducting a welfare analysis of temporary ownership, and by discussing optimal antitrust policy in the presence of temporary owners.

Our discussion of antitrust policy in a setting with repeated mergers implies that our paper also relates to the literature on mergers and antitrust review in a dynamic context.[7] In particular, Nocke and Whinston (2010) show that if each firm in a Cournot setting is involved in, at most, one potential merger and if disapproved mergers can still take place later, then a completely myopic consumer surplus based approval policy maximizes discounted consumer surplus. These conditions are not fulfilled in our setting: firms can be involved in multiple potential mergers and, furthermore, heterogeneity in ownership type implies that objective functions of firms differ. It is thus essential that antitrust authorities are forward looking when it comes to antitrust policy in the presence of temporary owners.

The central mechanism in our paper relies on auctions with externalities, which brings our paper close to the literature on endogenous ownership and efficiency dating back to Coase (1960). He argued that in a zero-transaction world, laissez-faire always leads to optimal outcomes irrespective of the initial assignment of property rights. Departing from the zero transaction cost assumption, authors such as Grossman and Hart (1986) and Hart and Moore (1990), have shown that ownership structure has implications for efficiency when contracts are incomplete. In particular, Jehiel and Moldovanu (1999) shows that ownership allocation in a resale market is not efficient when auctions have externalities and contracts are incomplete. We contribute to this literature by examining the outcome in a resale market in which investments take place prior to resale. This enables us to show that owners buying firms for resale have incentives to overinvest in relation to the eventual acquirers first best as a result of the externalities in the resale auction. Hence, not only can the ownership allocation be distorted but investments can be distorted as well.[8]

Finally, since our paper deals with private equity firms undertaking leveraged buyouts, our analysis

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[4]See, for example, Salant et al. (1983), Perry and Porter (1985), Deneckere and Davidson (1985), Farrell and Shapiro (1990), and Gilbert and Newbery (1992). Our paper also relates to the "exogenous merger" literature in finance showing that mergers can be triggered by changes in productivity and cost of capital (Jovanovic and Rousseau (2002) and Maksimovic and Phillips (2002)).

[5]See, for instance, Kamien and Zang (1990),Gowrisankaran (1999), Horn and Persson (2001), and Fridolfsson and Stennek (2005).

[6]See, for instance, Norbäck and Persson (2008), Friberg, Norbäck, and Persson (2008), Fabrizi, Lippert, Norbäck, and Persson (2008), Norbäck, Persson, and Svensson (2011) and Norbäck, Persson, and Tåg (2011).

[7]See, for instance, Nilssen and Sorgard (1998), Motta and Vasconcelos (2005) and Nocke and Whinston (2010).

[8]The overinvestment effect is also present in Katz and Shapiro (1986), who study the optimal licensing fee of a research lab which can affect the size of the innovation, but in their paper the ownership structure is not determined.

also relates to the finance literature. The seminal (informal) work on buyouts proposed that private equity firms are specialists at solving managerial agency problems, mainly through closer monitoring, extensive use of debt and giving the manager ownership in the firm (Jensen (1986) and Jensen (1989)). By concentrating ownership, they solve free-rider problems related to dispersed ownership (Berle and Means (1932); Jensen and Meckling (1976)). This literature has, however, not focused on temporary ownership, endogenous ownership, product market effects, antitrust policy or conducting welfare analyzes. Our paper also relates to the literature on the interaction between product markets and leverage. This literature has, among other mechanisms, demonstrated that limited liability commits a leveraged firm to producing more output in the product market since shareholders care more about positive than negative states of the world (Brander and Lewis (1986)) and that firms with deep pockets (good access to financial markets) have incentives to prey on financially weaker rivals to force them out of the market (Bolton and Scharfstein (1990)).[9] Our paper (though the governance structure) is the first to establish a connection between the capital structure of the firm and temporary ownership. Hence our model provides new empirically testable hypotheses on the connection between capital structures, product markets, investor horizons and determinants of IPOs.

3   The Model

3.1   Setup

We consider an oligopoly industry served by a set $\mathcal{I} = \{1, 2, .., i, ..., n\}$ of symmetric incumbents, each possessing the basic assets necessary for production. The industry also contains a target firm. 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 is illustrated in Figure I and proceeds as follows.

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.[10] Denote the new owner type $l \in \mathcal{L} = \mathcal{I} \times \mathcal{J}$. Due to the symmetry with firm types, an owner is either an incumbent buying to keep ($l = k$) or a private equity firm buying to sell ($l = s$).

In stage two, the new owner hires a manager to restructure the target. The new owner must provide incentives for the manager to exert effort and implements a governance structure of intensity g_l. The manager then determines the amount of restructuring $r(g_l)$ to be undertaken.

In stage three, if the target was bought by a private equity firm, the private equity firm arranges a first price perfect information auction to sell the restructured target.[11] The bidders are the rival incumbents in the industry. We term the exit a trade sale if a rival incumbent wins the auction and an IPO if the

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[9]See also Brander and Lewis (1988), Maksimovic (1988), and Fudenberg and Tirole (1986).
[10]We discuss other potential selling mechanisms in Appendix A.
[11]In Appendix A we discuss the possibility of incumbents also buying assets with the intent of selling them.

Figure I: The timing of the game.

Target

- -

Stage 1: The Acquisition Auction

The target firm is acquired by a private equity firm or an incumbent firm.

Auction

Incumbent acquisition, l=k

Private equity buyout, l=s

k s

- -

Stage 2: Restructuring

   (i) Governance: *The owner hires a manager and sets a governance structure.*

g_k g_s

- -

   (ii) Restructuring: *The manager chooses restructuring intensity given the governance structure.*

Manager   *Manager*

$r(g_k)$ $r(g_s)$

s

- -

Stage 3: The Exit Stage

A private equity firm chooses between undertaking a trade sale or an IPO.

Trade sale   *IPO*

- -

Stage 4: Oligopoly interaction

Product market interaction between the incumbent firms takes place

$\mathcal{I} = \{1, 2, .., i, \ldots, n\}$ $\mathcal{I} \times s$

$$\left\{ \begin{array}{l} x_A(r(g_k), k) \\ \mathbf{x}_{NA}(r(g_k), k) \end{array} \right. \quad \left\{ \begin{array}{l} x_A(r(g_s), k) \\ \mathbf{x}_{NA}(r(g_s), k) \end{array} \right. \quad \left\{ \begin{array}{l} x_S(r(g_s), s) \\ \mathbf{x}_{NA}(r(g_s), s) \end{array} \right.$$

- -

Notes. This figure illustrates and describes the four stage game we analyze: the initial acquisition auction, the restructuring and governance structure stage, the exit auction, and oligopoly product market interaction.

firm is not sold to an incumbent and instead is bought by an outsider to the industry. To underscore the main mechanism, we start the analysis in this section by assuming that only exit by trade sale is possible. We then generalize the model to include IPOs in Section 5.[12]

In stage four, incumbents compete in the product market by setting price or quantity (x_i) given restructuring ($r(g_l)$) and the identity of the firm who owns the restructured target.

3.2 Stage 4: Product Market Interaction

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 do not own assets in this stage and hence do not produce.

Using the ex-ante symmetry among incumbents, we distinguish between two firm types h: the acquiring incumbent ($h = A$) and the non-acquiring incumbents ($h = NA$). An incumbent of type $h = \{A, NA\}$ chooses an action $x_h \in R^+$ to maximize the direct product market profit $\Pi_h(x_h, \mathbf{x}_{-h}, r)$. The profit depends on its own actions x_h; its rivals' actions $\mathbf{x}_{-h}$ (an $(N-1) \times 1$ vector); how much the target has been restructured (r); and whether the incumbent is an acquirer ($h = A$) or a non-acquirer ($h = NA$). We assume that a unique Nash-Equilibrium in actions, $\mathbf{x}^*(r)$, exists and that it is defined from the first-order conditions

$$\frac{\partial \Pi_A}{\partial x_A}(x_A^*(r), x_{-A}^*(r), r) = 0, \quad \frac{\partial \Pi_{NA}}{\partial x_{NA}}(x_{NA}^*(r), x_{-NA}^*(r), r) = 0. \tag{1}$$

We can then define the reduced-form product market profits of the acquirer and a non-acquirer as direct functions of the level of restructuring r: $R_A(r) \equiv \Pi_A(x_A^*(r), x_{-A}^*(r), r)$ and $R_{NA}(r) \equiv \Pi_{NA}(x_{NA}^*(r), x_{-NA}^*(r), r)$. We make the assumption that restructuring increases the profits of the acquirer, but reduces the profits for non-acquiring incumbents as they must compete with a better rival.

Assumption 1. $\frac{dR_A}{dr} > 0$ and $\frac{dR_{NA}}{dr} < 0$.

Our notion of restructuring is based on private equity firms implementing governance, financial and operational improvements to restructure the target.[13] The empirical literature based on deals in the 1980s has suggested that private equity firms to a large extent purchase under-performing firms with entrenched managers, too high capital expenditures, and over-diversified business lines. However, more recent evidence suggests that private equity firms today are more oriented towards operational improvements and helping firms grow.[14] Our formalization of restructuring says that the profitability of the target increases in restructuring, and that rivals' profits decrease in restructuring, which is compatible with both restructuring underperforming firms and helping capital-starved firms grow.

Assumption 1 is compatible with several oligopoly models, for example the Linear Cournot model.

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[12] Kaplan and Strömberg (2009) report that 38% of all realized exits world-wide are trade sales and 14% are IPOs.
[13] See Jensen (1989) or Kaplan and Strömberg (2009).
[14] See, for instance, Boucly, Sraer, and Thesmar (2011), Olsson and Tåg (2012) or Kaplan and Strömberg (2009).

Example 1. The Linear Cournot Model. The oligopoly interaction is Cournot competition with homogenous goods. The product market profit is $\Pi_i = (P - c_i)q_i$ where firms face inverse demand $P = a - Q$, where $a > 0$ is a demand parameter and $Q = \Sigma_{i=1}^n q_i$ is aggregate output. Acquiring the restructured target reduces the marginal cost. Making a distinction between firm types, we have:

$$c_A = c - \gamma r, \qquad c_{NA} = c. \tag{2}$$

The parameter $\gamma > 0$ measures how effective restructuring is where $\gamma > 1$ can be thought of as synergies arising from complementarities between the target and acquiring firm's assets. Equation (1) take the form $\partial \Pi_h / \partial q_h = P - c_h - q_h = 0$ for $h = \{A, NA\}$, which can be solved for optimal quantities $\mathbf{q}^* = (q_h^*, q_{-h}^*)$. Here q_h^* is the output of a firm of type h and q_{-h}^* is the output of its competitors. Reduced-form profits are $R_h = [q_h^*]^2$ since $\partial \Pi_h / \partial q_h = 0$ implies $P - c_h = q_h^*$. The equilibrium outputs are $q_A^* = (a - c + n\gamma r)/(n+1)$ and $q_{NA}^* = (a - c - \gamma r)/(n + 1)$, which satisfies $dR_A/dr > 0$ and $dR_{NA}/dr < 0$.

Assumption 1 is also compatible with many other oligopoly models with other competitive modes, cost and demand structures, such as Bertrand models with differentiated products and multi-plant models as long as restructuring either affects the variable production cost or the quality of the product sold by the acquiring incumbent. In Appendix A, we show that Assumption 1 is fulfilled for many parameter values in the differentiated product multi-plant model where the acquiring incumbent and the target firm hold different varieties of the good or service.[15]

3.3 Stage 3: The Exit Auction

If a buyout takes place in stage one, the private equity firm exits its investment through a first price perfect information auction with externalities in stage three.[16] The n incumbents simultaneously post bids, which are accepted or rejected by the private equity firm. Each incumbent announces a bid b_i, with $\mathbf{b} = (b_1, ..., b_i, ...b_n) \in R^n$ being the vector of these bids. Following the announcement of $\mathbf{b}$, 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.

The exit auction is solved for Nash equilibria in undominated pure strategies. An incumbent's maximum willingness to pay for the target is

$$\omega_{kk} = R_A(r) - R_{NA}(r). \tag{3}$$

The first term shows the profit for the incumbent if it obtains the target. The second term shows the

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[15]Intuitively, what we need to be concerned about is that an incumbent could be so efficient at producing its own product that an increase in restructuring of the target's product will cannibalize on profitable sales in the incumbent's original plant. Aggregate profits could then be reduced and Assumption 1 would no longer hold.

[16]For more on these auctions, see Jehiel and Moldovanu (1999), Jehiel et al. (1999) or Jehiel and Moldovanu (2000).

profit of the same incumbent if it does not obtain the target and is forced to compete with a rival that obtained the target. Denoting the equilibrium trade sale price as $S^3(r)$, Lemma 1 follows.

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

Proof. See Appendix B. □

Intuitively, the incumbents are ex-ante symmetric so they will all post the same bid equal to their maximum valuation ω_{kk}.

3.4 Stage 2: Governance and Restructuring

In stage two, the new owner hires a manager to restructure the target. The new owners (an incumbent or a private equity firm) decide on a governance structure g defined as a measure implemented by the owners to induce more restructuring efforts by the manager. More specifically, in a first period of stage two the new owner hires a manager and sets a governance structure. Given the governance structure, the manager restructures the target in the second period of stage two. We solve stage two by backward induction.[17]

Consider first restructuring by the manager given the governance structure. Let the utility of the manager be $U(r,g) = w(r,g) - e(r)$, where $w(r,g)$ is the benefit to the manager from doing more restructuring with $w_r' > 0$. The effort cost (or private benefit loss) from restructuring for the manager is represented by $e(r)$, with $e' > 0$ and $e'' > 0$. For a given governance structure g, the optimal restructuring by the manager is $r^*(g) = \arg\max_r U(r,g) = w(r,g) - e(r)$, with associated first order condition

$$w_r' = e(r^*(g)). \tag{4}$$

Assuming that $U(r,g)$ is strictly concave in g, and that better governance increases the managers marginal pay-off of restructuring ($w_{rg}'' > 0$), better governance increases restructuring efforts. This follows from differentiating the first-order condition in equation (4) to obtain

$$\frac{dr^*}{dg} = -\frac{w_{rg}''}{w_{rr}'' - e_{rr}''} > 0. \tag{5}$$

The optimal restructuring as a function of the governance structure is illustrated in Figure II(i). To proceed, it is useful to define reduced-form profit functions $R_A(g) \equiv R_A(r^*(g))$ and $R_{NA}(g) \equiv R_{NA}(r^*(g))$, and the reduced-form utility for the managers as $U(g) = w(r^*(g), g) - e(r^*(g))$.

Next, we solve for the optimal governance structure. Restructuring is associated with two types of costs for the owners: variable restructuring costs are $k(r)$, with $k'(r) > 0$ and the cost of imposing a

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[17]In Appendix A, we discuss the possibility of non-acquiring incumbents restructuring their assets in response to an acquisition by an incumbent or a private equity firm.

governance structure are $c(g)$ with $c'(g) > 0$.[18] Define total variable restructuring costs as a reduced-function of g as $C(g) = k(r^*(g)) + c(g)$, with $dC/dg = (dk/dr)(dr^*/dg) + c'(g) > 0$ (which we denote by $C'(g)$ for simplicity) and $d^2C/dg^2 > 0$. Fixed restructuring costs for incumbents are F. Private equity firms have a fixed restructuring cost of $F - \Delta$ with a potential advantage equal to $\Delta \geq 0$. In section 7 we endogenize Δ by allowing both private equity firms and incumbents to invest in reducing fixed costs from F to $F - \Delta$.

Suppose first an incumbent obtained the target in stage one. The incumbent will maximize net profits by choosing the governance structure g_k optimally: $g_k^* = \arg\max_g[R_A(g) - C(g) - F]$ with the associated first-order condition

$$\frac{dR_A}{dg} = \frac{dR_A}{dr}\frac{dr^*}{dg} = C'(g_k^*). \tag{6}$$

The optimal governance structure g_k^* is shown at point K in Figure II(ii). The marginal revenue is $(dR_A/dr)(dr^*/dg)$, consisting of the marginal increase in restructuring from better governance ($dr^*/dg > 0$) and the marginal effect of restructuring on profits ($dR_A/dr > 0$). The marginal cost is $C' = (dk/dr)(dr^*/dg) + c'(g)$, consisting of the marginal increase in restructuring costs $(dk/dr)(dr^*/dg)$ and the marginal increase in costs of governance ($c'(g)$).

Suppose now that a private equity firm obtained the target in stage one. The private equity firm will maximize the equilibrium trade sale price by choosing the governance structure g_s optimally: $g_s^* = \arg\max_g[S^3 - C(g) - (F - \Delta)]$ with $S^3 = R_A(g) - R_{NA}(g)$. The associated first-order condition is
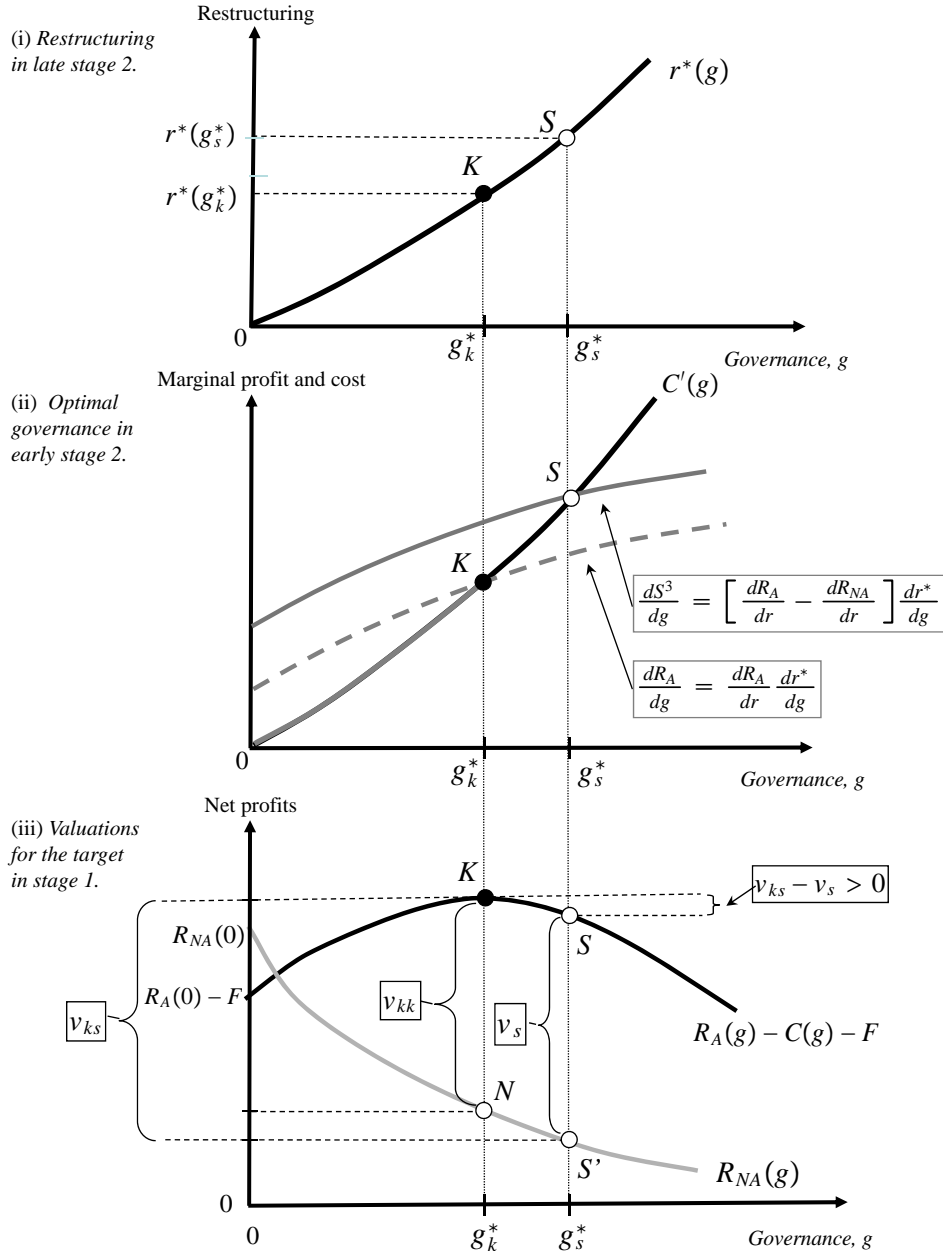
$$\frac{dS^3}{dg} = \left[\frac{dR_A}{dr} - \frac{dR_{NA}}{dr}\right]\frac{dr^*}{dg} = C'(g_s^*). \tag{7}$$

The optimal governance structure g_s^* is shown point S in Figure II(ii). Compare the first order conditions in equations (6) and (7). Both types of firms have the same marginal cost (C'). However, the marginal revenue is not the same. An incumbent accounts for how governance affects product market profits $((dR_A/dr)(dr^*/dg) > 0)$, while a private equity firm accounts for how governance affects the trade sale price. The trade sale price increases both because product market profits increase $((dR_A/dr)(dr^*/dg) > 0)$, and because product market profits of non-acquiring incumbents decrease $((dR_{NA}/dr)(dr^*/dg) < 0)$. This is illustrated in Figure II(ii) by the marginal revenue curve of a private equity firm lying above an incumbents marginal revenue curve. In Figure II(ii) the location of point S is to the right of point K. Since better governance translates into increased restructuring efforts, managers in private equity backed firms do more restructuring $(r^*(g_s^*) > r^*(g_k^*))$ which is illustrated in Figure II(i).

Proposition 1. *Private equity backed firms have stronger governance structures than incumbents ($g_s^* > g_k^*$) and subsequently undertake more restructuring ($r^*(g_s^*) > r^*(g_k^*)$).*

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[18]At the end of this subsection, we give explicit examples of $c(g)$: the cost $c(g)$ can be the wage costs of the manager ($c(g)$ equals $w(r, g)$), it could be monitoring costs imposed on the firm, or it could be costs associated with greater leverage (if leverage induces the manager to work harder).

Figure II: Optimal governance, restructuring and ownership.

(i) *Restructuring in late stage 2.*

Restructuring

$r^*(g)$

S

$r^*(g_s^*)$

K

$r^*(g_k^*)$

0 g_k^* g_s^* *Governance, g*

(ii) *Optimal governance in early stage 2.*

Marginal profit and cost

$C'(g)$

S

K

$$\frac{dS^3}{dg} = \left[\frac{dR_A}{dr} - \frac{dR_{NA}}{dr} \right] \frac{dr^*}{dg}$$

$$\frac{dR_A}{dg} = \frac{dR_A}{dr} \frac{dr^*}{dg}$$

0 g_k^* g_s^* *Governance, g*

(iii) *Valuations for the target in stage 1.*

Net profits

K

$v_{ks} - v_s > 0$

$R_{NA}(0)$

$R_A(0) - F$

v_{ks} v_{kk} v_s S

$R_A(g) - C(g) - F$

N

S'

$R_{NA}(g)$

0

0 g_k^* g_s^* *Governance, g*

Notes. Part (i) of this figure illustrates that restructuring intensity r increases with governance g. Part (ii) illustrates how temporary owners maximizing the trade sale price sets governance higher than permanent owners maximizing product market profits ($g_s^* > g_k^*$). Part (iii) illustrates how the valuations of incumbents and private equity firms depend on governance intensity ignoring the fixed cost advantage Δ. In equilibrium, $v_{ks} > v_s$ so a private equity buyout cannot take place because incumbents have incentives to prevent the buyout.

The governance structure could take many forms, but most relevant for private equity firms is managerial ownership, debt, and monitoring. In the following examples, we assume that the private effort of the manager $e(r)$ and the restructuring cost $k(r)$ for the firm are increasing convex functions.

Example 2. Managerial ownership. The utility of the manager is $U(r,g) = w(r,g) - e(r)$ where g is a share of ownership in the firm for a manager. Then, the payment to the manager is $w(r,g) = g[R_A(r) - k(r) - F]$. Since equation (4) takes the form $g[r^*(g)(dR_A/dr) - k'] = e(r^*(g))$, we have $w'_r = g[r(dR_A/dr) - k'(r)] > 0$ and $w''_{rg} = r(dR_A/dr) + k'(r) > 0$. Hence, from equation (5), $dr^*/dg > 0$. The cost for the firm is $C(g) = k(r^*(g)) + c(g)$, where $c(g) = g[R_A(r^*(g)) - k(r^*(g)) - F]$ with $dc(g)/dg = R_A(r^*(g)) - k(r^*(g)) - F + g[r^*(g)(dR_A/dr) + k'](dr^*/dg) > 0$. Hence, $C'(g) > 0$ and from equations (6) and (7) we have $g_s^* > g_k^*$ and $r^*(g_s^*) > r^*(g_k^*)$.

Example 3. Debt. Suppose that the manager receives a fixed wage of b but is sacked if the firm runs into financial trouble: $w(r,g) = \rho(r,g)b$, with $\rho(r,g)$ being the probability of default with $\frac{d\rho}{dr} < 0$. Then, $w'_r = b\frac{d\rho}{dr} < 0$ $w''_{rg} = \rho''_{rg}(r,g)b > 0$ if increased debt levels makes the probability of default more sensitive to restructuring efforts. The cost of financial distress is $c(g)$ with $dc(g)/dg > 0$. From equations (6) and (7) we have $g_s^* > g_k^*$ and $r^*(g_s^*) > r^*(g_k^*)$.

Example 4. Monitoring. Suppose that the manager receives a fixed wage of b but is sacked if he or she is found shirking: $w(r,g) = \rho(r,g)b$, with $\rho(r,g)$ being the probability of being detected shirking with $\frac{d\rho}{dr} > 0$. Then $w''_{rg} = \rho''_{rg}(r,g)b > 0$ if increased monitoring makes the probability of being detected more sensitive to restructuring efforts. The cost of monitoring is $c(g)$ with $dc(g)/dg > 0$. From equations (6) and (7) we have $g_s^* > g_k^*$ and $r^*(g_s^*) > r^*(g_k^*)$.

These examples are consistent with empirical evidence that private equity backed firms have higher managerial ownership, higher leverage and are more productive.[19] Our model also predicts that leverage will decrease once the private equity firm has exited their investment. In addition to these examples, we show in Appendix A that our general specification includes governance structures such that (i) private equity backed firms offer managers a share of the trade sale price; (ii) managerial ownership is combined with a fixed wage for the manager; and (iii) there are exogenous cost advantages for private equity firms in variable restructuring costs.

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[19]For managerial ownership, see Kaplan (1989), Leslie and Oyer (2009) and Acharya and Kehoe (2008); for leverage see Axelson et al. (2010) and Leslie and Oyer (2009); and for productivity see Lichtenberg and Siegel (1990); Amess (2003); Harris et al. (2005) and Davis et al. (2009).

3.5 Stage 1: The Acquisition Auction

The acquisition auction in stage one is a first price perfect information auction with externalities. We solve 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.[20] Each incumbent and private equity firm announces a bid b_i, with $\mathbf{b} = (b_1, ..., b_i, ...b_{n+m}) \in R^{n+m}$ is the vector of these bids. Following the announcement of $\mathbf{b}$, 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.

Since the auction has externalities, the maximum valuations are determined as profits from winning the auction *in relation to* profits from losing it. We define the valuations v_s, v_{kk} and v_{ks} as follows.

- v_s is the valuation of obtaining the target for a private equity firm. Evaluate the profit for a private equity firm at g_s^* to obtain

$$v_s = \underbrace{R_A(g_s^*) - R_{NA}(g_s^*)}_{\text{Trade sale price } S^{3^*}(g_s^*)} - C(g_s^*) - (F - \Delta). \tag{8}$$

- v_{kk} is an incumbent's valuation of obtaining the target *if another incumbent would otherwise have obtained it*. Evaluating the profit of an acquiring incumbent and the profit for a non-acquiring incumbent at g_k^*, we obtain

$$v_{kk} = \underbrace{R_A(g_k^*) - C(g_k^*) - F}_{\text{Acquire and restructure.}} - \underbrace{R_{NA}(g_k^*)}_{\text{A rival makes the acquisition.}}. \tag{9}$$

- v_{ks} is an incumbent's valuation of obtaining the target *if a private equity firm would otherwise have obtained it, restructured it, and sold it back to the industry*. Evaluating the profit of an incumbent at g_k^* and the profit for an non-acquiring incumbent at g_s^*, we obtain

$$v_{ks} = \underbrace{R_A(g_k^*) - C(g_k^*) - F}_{\text{Acquire and restructure.}} - \underbrace{R_{NA}(g_s^*)}_{\text{A buyout occurs.}}. \tag{10}$$

Given equations (8), (9) and (10), we derive the following Proposition.

Proposition 2. *A resistance to private equity buyouts exists in oligopolistic industries. In a pure strategy Nash-equilibrium, private equity firms need an advantage to outbid incumbents. Let $\overline{\Delta} \equiv R_A(g_k^*) - C(g_k^*) - [R_A(g_s^*) - C(g_s^*)] > 0$. For $\Delta < \overline{\Delta}$ the target is acquired by an incumbent at price $S^1 = v_s$. For $\Delta > \overline{\Delta}$ a buyout occurs at price $S^{1^*} = v_s$.*

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[20]In this section, we assume that the target firm has a reservation price of $v_t = 0$. We relax this assumption in section 6.

To prove Proposition 2 let us first establish a ranking between firms' valuations in equations (8)-(10). First, a private equity firm must have a higher valuation than an incumbent preempting a rival acquisition: $v_s > v_{kk}$. This follows since a private equity firm sets g to maximize incumbents willingness to pay net of restructuring costs, $g_s^* = \arg\max_g[S^{3^*} - C(g) - (F - \Delta)] = \arg\max_g[R_A(g) - R_{NA}(g) - C(g) - (F - \Delta)]$. Second, an incumbent preempting a private equity buyout must have a higher valuation than an incumbent preempting a rival acquisition: $v_{ks} > v_{kk}$. This holds because $v_{ks} - v_{kk} = R_{NA}(g_k^*) - R_{NA}(g_s^*) > 0$ since $g_s^* > g_k^*$. This tells us that firms' valuations fulfill

$$\min\{v_s, v_{ks}\} > v_{kk}. \tag{11}$$

Let us now show that the acquisition price must be $S^{1^*} = v_s$. Since multiple symmetric private equity firms bid for the target, the acquisition price S^1 must be at least v_s. Incumbents will not bid higher than v_s. If an incumbent believes that a rival will bid v_s, it has no incentive to bid higher since from equation (11) the value of preempting a rival is lower than the value of preempting a private equity firm ($v_{kk} < v_s$).

Which type of firm will buy the target? Compare the net profit of an incumbent that buys the target directly in stage one at price v_s ($\pi_A^1 = R_A(g_k^*) - C(g_k^*) - F - v_s$) to the net profit of the incumbent when buying a restructured target late in stage three from a private equity firm ($\pi_A^3 = R_{NA}(g_k^*) - S^{3^*} = R_{NA}(g_s^*)$). We obtain

$$\pi_A^1 - \pi_A^3 = R_A(g_k^*) - C(g_k^*) - F - \underbrace{[S^{3^*} - C(g_s^*) - (F - \Delta)]}_{S^{1^*} = v_s} - \underbrace{[R_A(g_k^*) - S^{3^*}]}_{\pi_A^3 = R_{NA}(g_s^*)}$$

$$= \underbrace{[R_A(g_k^*) - C(g_k^*)] - [R_A(g_s^*) - C(g_s^*)]}_{\overline{\Delta} > 0} - \Delta$$

$$= v_{ks} - v_s, \tag{12}$$

where $\overline{\Delta} \equiv R_A(g_k^*) - C(g_k^*) - [R_A(g_s^*) - C(g_s^*)] > 0$ since $g_k^* = \arg\max_g[R_A(g) - C(g)]$.

As shown by the first row of equation (12), an incumbent will pay the trade sale price S^{3^*}, either in the bidding competition in stage one with private equity firms or in the exit stage with rival incumbents. As revealed by the first term of the second row, a direct acquisition is then driven by the incentive to avoid costly overinvestment in restructuring (induced by overly strong governance structures from an incumbents perspective). Indeed, without an advantage in restructuring a buyout cannot occur. This is shown in Figure II(iii), where $v_{ks} - v_s > 0$. Only if the excessive investments are compensated for by a lower fixed restructuring cost ($\Delta > \overline{\Delta} > 0$) will a private equity firm be able to obtain the target (we close the model by endogenizing Δ in section 7)

Before we move to the welfare implications of temporary ownership, a remark is in order. The model

does not predict which incumbent will be selected to outbid the private equity firms: the gains from a direct preemptive acquisition by an incumbent in stage one are unevenly distributed among incumbents. A coordination failure among incumbents can then occur as $v_{ks} > v_s > v_{kk}$. The acquiring incumbent bears the cost of the acquisition, while the other incumbents can free-ride:

$$\underbrace{R_{NA}(g_k^*)}_{\text{Non-acquiring incumbent.}} > \underbrace{\pi_A^1 = R_A(g_k^*) - C(g_k^*) - F - v_s}_{\text{Acquiring incumbent paying } S^{1*} = v_s.} > \underbrace{R_{NA}(g_s^*)}_{\text{Incumbent if a buyout occurs.}}. \tag{13}$$

Under a coordination failure between incumbents, private equity firms can outbid the incumbents even though $v_{ks} > v_s$ and private equity firms have no advantages at restructuring ($\Delta = 0$). This can formally be shown by extending the auction in stage one to mixed strategy equilibria. In a mixed strategy equilibrium, incumbents can bid v_s with some probability, whereas private equity firms always bid their maximum valuation v_s. There are two possible outcomes: at least one incumbent bid v_s and a preemptive acquisition takes place, or no incumbents bid for the target and a private equity firm obtains it at price v_s.

4 Welfare Effects of Temporary Ownership

Overinvestment is beneficial for consumers as marginal costs are reduced, but it hurts rival firms in the industry. The balance of these two effects determine the impact on total welfare. To compare the first-best levels of governance and restructuring to the privately optimal ones, define total welfare as

$$W(g) = R_A(g) - C(g) - F + (n-1)R_{NA}(g) + CS(g), \tag{14}$$

where we, for simplicity, omit the manager. The first three terms correspond to producer surplus while the last term captures consumer surplus. The acquisition price does not appear in the producer surplus part because it is netted out between the acquiring firm and the target. Stronger governance and more restructuring leads to lower market prices, the reduced-form consumer surplus $CS(g) \equiv CS(r^*(g))$ is increasing in governance and restructuring: $(dCS/dr)(dr^*/dg) > 0$. We assume that $dW(0)/dg > 0$ and that $C(g)$ is sufficiently convex so that $W(g)$ is strictly concave. Then, a first-best interior optimum exists defined as $W^* = W(g^*)$ for $g^* = \arg\max_g W(g)$ and we can state the following proposition.

Proposition 3. *Temporary ownership increases total surplus ($W(g_s^*) > W(g_k^*)$) if $dW(g_s^*)/dg > 0$. In the Linear Quadratic Cournot model, this occurs when (i) temporary owners acquire good targets and make them great (such that the ex-post market share, output or price-cost margin is relatively high), (ii) when there are few rivals in the market, and (iii) when the marginal costs of governance and restructuring are low.*

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Figure III: First-best in relation to temporary and permanent ownership.
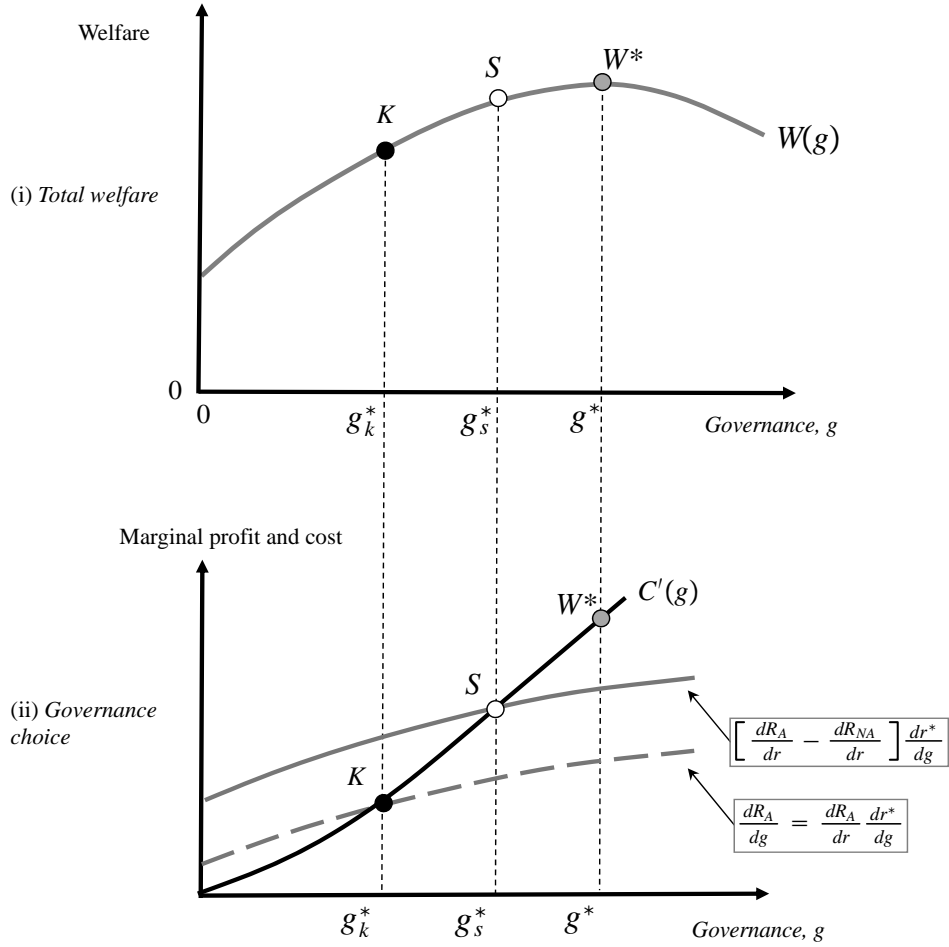
Notes. Part (i) illustrates that overinvestment by temporary ownership brings governance and restructuring levels closer to the first best optimum g^* if $dW(g_s^*)/dg > 0$ (the tangent at point S is upwards sloping). Otherwise overinvestment by temporary owners can lead to excessive governance structures and restructuring incentives in relation to first-best. Part (ii) displays how different objective functions result in higher governance and restructuring under temporary ownership compared to permanent ownership.

The proposition says that when $dW(g_s^*)/dg > 0$ holds, temporary ownership takes equilibrium governance and restructuring efforts closer to the first best ($g^* > g_s^* > g_k^*$). From Proposition 1 we know that $g_s^* > g_k^*$ and if the total surplus function is non-decreasing at the optimal level of governance for a temporary owner ($dW(g_s^*)/dg > 0$), then temporary ownership must increase total surplus relative to permanent ownership if the welfare function is strictly concave. The intuition is illustrated in Figure III. Figure III(ii) displays how the incentive to maximize the trade sale price brings governance levels up to point S from K under permanent ownership. Figure III(i) then illustrates the effect on total welfare of the overinvestment. Total welfare increases since S is closer to the first best outcome W^*.

Figure III(i) also makes it clear that temporary ownership could decrease total welfare if overinvestment pushes S to the right of W^* (which occurs if $dW(g_s^*)/dg < 0$). A sufficient condition for total welfare to decrease is if point K is to the right of W^*, so a permanent owner also invests too much

$(g_k^* > g^*)$. Then, temporary ownership unambiguously decreases welfare. If K is located to the left of W^* and S is located to the right of W^*, a trade-off exists between too low governance under permanent ownership $(g_k^* < g^*)$ and too high governance levels under temporary ownership $(g_s^* > g^*)$.

To get a sense for when temporary ownership increases welfare, we make use of the Linear Quadratic Cournot model. Total surplus can be rewritten as $W(g) = S^{3^*}(g) - C(g) - F + nR_{NA}(g) + CS(g)$ using $S^{3^*}(g) = R_A(g) - R_{NA}(g)$. From the envelope theorem we then obtain

$$\frac{dW(g_s^*)}{dg} = CS_g'(g_s^*) + n\frac{dR_{NA}(g_s^*)}{dg}. \tag{15}$$

The first term gives the positive externality on consumers through increased restructuring whereas the second term shows the negative externality on rivals' profits. In the Linear Quadratic Cournot model (assuming that $r^*(g) = g$ and noting that $s_A(g_s^*) + (n-1)s_{NA}(g_s^*) = 1$) equation (15) becomes

$$\frac{dW(g_s^*)}{dg} = \frac{nQ(g_s^*)}{n-1}\left[s_A(g_s^*) - \left(\frac{1}{2} + \frac{1}{2n}\right)\right]\frac{dQ(g_s^*)}{dg}. \tag{16}$$

Equation (16) is positive whenever the ex-post market share of the firm owning the restructured assets $(s_A(g_s^*) = q_A^*(g_s^*)/Q(g_s^*))$ is sufficiently large (above $1/2 + 1/2n$). Intuitively, the negative effects on rivals in the industry from overinvestment are small because rivals' output or price-cost margin $(q_{NA}^*(g_s^*) = P(g_s^*) - c)$ are small.[21] The low output or price cost margin stems from a low product market price $(P(g_s^*))$ induced by higher ex-post governance $(q_A^*(g_s^*))$. At the same time, the effect on consumer surplus is greater because of a lower price on a larger total sales volume $(Q(g_s^*))$.

Let us now illustrate that total welfare increases (the ex-post market share of the firm owning the restructured assets is large) when there are few rivals in the market (n is small), and when the marginal costs of governance and restructuring are low (μ is low). Figure IV depicts the welfare differential $W(g_s^*) - W(g_k^*)$ over the convexity of the cost function $C(g)$, as measured by the efficiency parameter μ, and the number of incumbent firms $n \geq 2$. Below the dashed white line (corresponding to $dW(g_s^*)/dg = 0$), the firm owning the restructured assets has a large market share: $s_A(g_s^*) > (1/2 + 1/2n)$. This occurs when governance and restructuring costs μ are low and the number of rivals n is low. Since $dW(g_s^*)/dg > 0$, temporary ownership increases total welfare (S and K are to the left of W^* in Figure III). The locus $s_A^*(g_S^*) = 1$ provides a lower bound on μ as rivals need have a positive market share. At higher restructuring costs, the market share of rivals will increase. In the north-east region of the diagram, the welfare differential, evaluated at the optimal governance by a permanent owner, is negative, $dW(g_k^*)/dg = 2Q(g_k^*)[s_A(g_k^*) - 1/2](dQ(g_s^*)/dg) < 0$, as $s_A(g_k^*) > 1/2$. With overinvestment, $g_s^* > g_k^*$,

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[21] The second term in equation (15) becomes $ndR_{NA}(g_s^*)/dg = nP_g'(g_s^*)q_{NA}^*(g_s^*) < 0$. This follows from $\frac{dR_{NA}(g_s^*)}{dg} = \frac{\partial R_{NA}}{\partial g} + \frac{\partial R_{NA}}{\partial q_{NA}}\frac{dq_{NA}^*}{dg} + \frac{\partial R_{NA}}{\partial q_{-NA}}\frac{dq_{-NA}^*}{dg}$, where $\frac{\partial R_{NA}}{\partial g} = \frac{\partial R_{NA}}{\partial q_{NA}} = 0$. Since $R_{NA}(g_s^*) = (P(g_s^*) - c)q_{NA}^*$, it follows that $\frac{dR_{NA}(g_s^*)}{dg} = P_g'q_{NA}^*$ where $P_g' = \frac{dP}{dq_{-NA}}\frac{dq_{-NA}^*}{dg} < 0$. In this expression, q_{-NA} is the output of the rivals to a non-acquiring permanent owner. It holds that $dq_{-NA}^*/dg > 0$.

Figure IV: Total welfare in the Linear Cournot model.
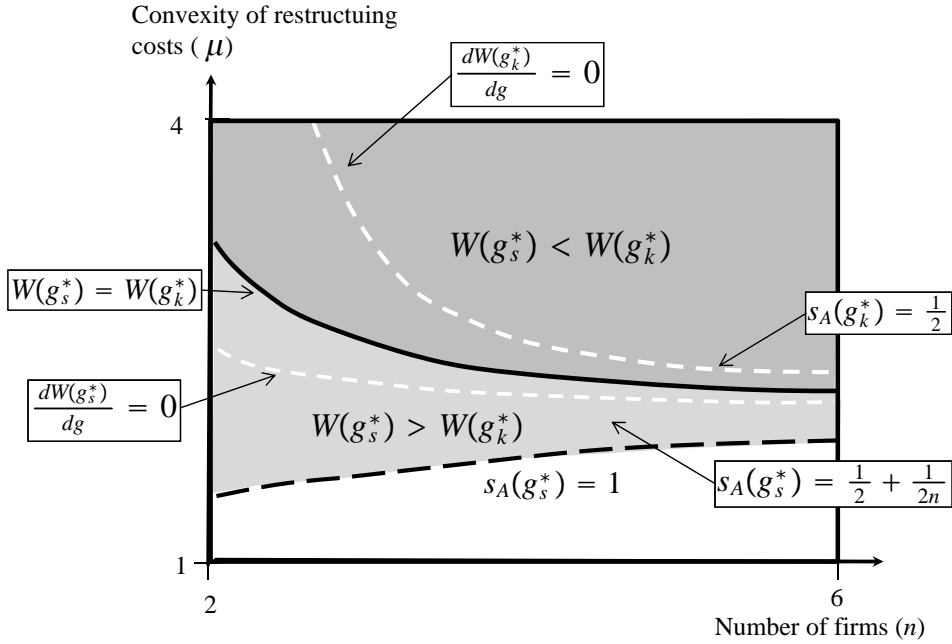
Notes. The figure illustrates how in the Linear Cournot model overinvestment by temporary owners leads welfare increases or decreases depending on governance and restructuring costs μ and the number of firms in the industry n.

temporary ownership reduces welfare: $W(g_s^*) < W(g_k^*)$ (points S and K will be to the right of the first best W^* in Figure III). In the middle region, a trade-off between too low incentives under permanent ownership and too high incentives under temporary ownership exists.

5   A Generalized Model: Trade Sales and IPOs

So far we have assumed that private equity firms exit their investment via a trade sale. In this section we extend the model to allow for an exit through an initial public offering (IPO) in stage three. Formally, we will model an IPO as a sale of the restructured target to a firm outside the industry. It can also refer to selling the restructured target to dispersed shareholders or selling the firm to another private equity firm (secondary buyout) who ends up producing in the market.

The analysis in this section is more involved (and can be skipped by a mildly interested reader) but it serves two important purposes. First, the analysis shows that overinvestment in governance and restructuring will still occur when exit through an IPO is possible. However, when the focus is on exiting through an IPO, strategic product market effects matter less for the exit valuation and so governance and restructuring incentives are weaker as compared to when the focus is on exiting through a trade sale. Second, the extension is crucial for the analysis of optimal antitrust policy in the next section. With IPO as an exit mode the number of firms in the product market can be preserved after a buyout, but this occurs at the expense of weaker governance structures and lower restructuring efforts. Incumbents

preemption incentives are, however, weaker as a result: buyouts followed by IPOs will meet less resistance from incumbents than buyouts followed by trade sales.

5.1 Stage 4: Product Market Interaction

The product market interaction stage must now allow for one more firm in the market (the right most "leg" in Figure I). Using the ex-ante symmetry among incumbents, if an IPO occurs we distinguish between two firm types h: the entering outsider ($h = S$) and the non-acquiring incumbents ($h = NA$). An incumbent of type $h = \{S, NA\}$ chooses an action $x_h \in R^+$ to maximize the direct product market profit $\Pi_h(x_h, \mathbf{x}_{-h}, r, s)$ where $l = s$ reminds us that a private equity firm bought the assets in stage one and exited through an IPO.

After an IPO, the Nash-equilibrium is given by

$$\frac{\partial \Pi_S}{\partial x_s}(x_s^*, x_{-s}^*; r, s) = 0, \ \ \frac{\partial \Pi_{NA}}{\partial x_{NA}}(x_{NA}^*, x_{-NA}^*; r, s) = 0. \tag{17}$$

The reduced-form product market profits for the entering outsider are $R_S(r, s) \equiv \Pi_S((x_S^*(r, s), x_{-S}^*(r, s); r, s)$ and for non-acquirers they are $R_{NA}(r, s) \equiv \Pi_{NA}((x_S^*(r, s), x_{-S}^*(r, s); r, s)$. When an incumbent has acquired the target in stage one, or if a buyout in stage one is followed by an exit by trade sale in stage three, equation (1) applies with n incumbents interacting in the product market. We then write incumbents reduced-form profits as $R_A(r, k)$ and $R_{NA}(r, k)$ to emphasize that the product market interaction takes place under incumbent ownership ($l = k$) as opposed to when a private equity buyout took place in stage one ($l = s$).

5.2 Stage 3: The Exit Auction

In the exit stage the n incumbents and the outsider simultaneously post bids, which are accepted or rejected by the private equity firm. We need to determine three valuations:

- The value to the outsider from buying the firm through an IPO is

$$\omega_s = R_S(r, s) - G, \tag{18}$$

  where G is a fixed cost undertaking an IPO (paid either by seller or the buyer).

- The value for an incumbent of deterring an IPO by preemptively acquiring the restructured assets is

$$\omega_{ks} = R_A(r, k) - R_{NA}(r, s). \tag{19}$$

- The value for an incumbent to prevent a rival incumbent from acquiring the target from the private

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equity firm is

$$\omega_{kk} = R_A(r,k) - R_{NA}(r,k). \qquad (20)$$

Due to stronger product market competition under an outside acquisition ($l = s$), $R_{NA}(r,k) > R_{NA}(r,s)$ holds and hence the IPO deterring valuation is larger than the preemptive valuation ($\omega_{ks} > \omega_{kk}$). We make the following simplifying assumption.

Assumption 2. $\frac{dR_A}{dr} - \frac{dR_S}{dr} > \frac{dR_{NA}(r,l)}{dr}$ *and* $\frac{dR_{NA}(r,l)}{dr} < 0$

This assumption tells us that the difference in the marginal effect on incumbent's profits (dR_A/dr) and the marginal effect on the IPO profit (dR_S/dr) is larger than the marginal effect on non-acquiring incumbent's profits ($dR_{NA}(r,l)/dr$).[22]

Let us solve the exit stage three in terms of r. It is useful to define an incumbent's *net value of deterring an exit* by IPO as $\Delta_{ID}(r) = \omega_{ks}(r) - \omega_s(r)$, and an incumbent's *net value of preempting a rival acquisition* under exit from trade sale as $\Delta_{PE}(r) = \omega_{kk}(r) - \omega_s(r)$. Defining cut-off levels of restructuring r^{PE} from $\Delta_{PE}(r^{PE}) = 0$, and r^{ID} from $\Delta_{ID}(r^{ID}) = 0$, where $r^{ID} < r^{PE}$ since $\Delta_{ID}(r) > \Delta_{PE}(r)$ from $R_{NA}(r,k) > R_{NA}(r,s)$. We can then state the following Lemma:

Lemma 2. *Assume that Assumption 2 holds and that $r^{ID} > r^{PE} > 0$ exist. An IPO then takes place if $r \in (0, r^{ED})$, a trade sale where the incumbent is driven by the incentive to deter an IPO at price $S^{3^*} = \omega_s(r)$ takes place for $r \in [r^{ID}, r^{PE})$, and a trade sale under preemptive bidding competition at price $S^{3^*} = \omega_{kk}(r)$ occurs for $r \in [r^{PE}, r^{\max})$.*

The Lemma is illustrated in Figure V(i). When little restructuring is conducted, $r \in (0, r^{ID})$, the net value for deterring an outside acquisition is negative $\Delta_{ID}(r) = \omega_{ks}(r) - \omega_s(r) < 0$, i.e. an incumbent's valuation $\omega_{ks}(r)$ is lower than the value of an IPO $\omega_s(r)$. In this region, the private equity firm will therefore choose to exit through an IPO.
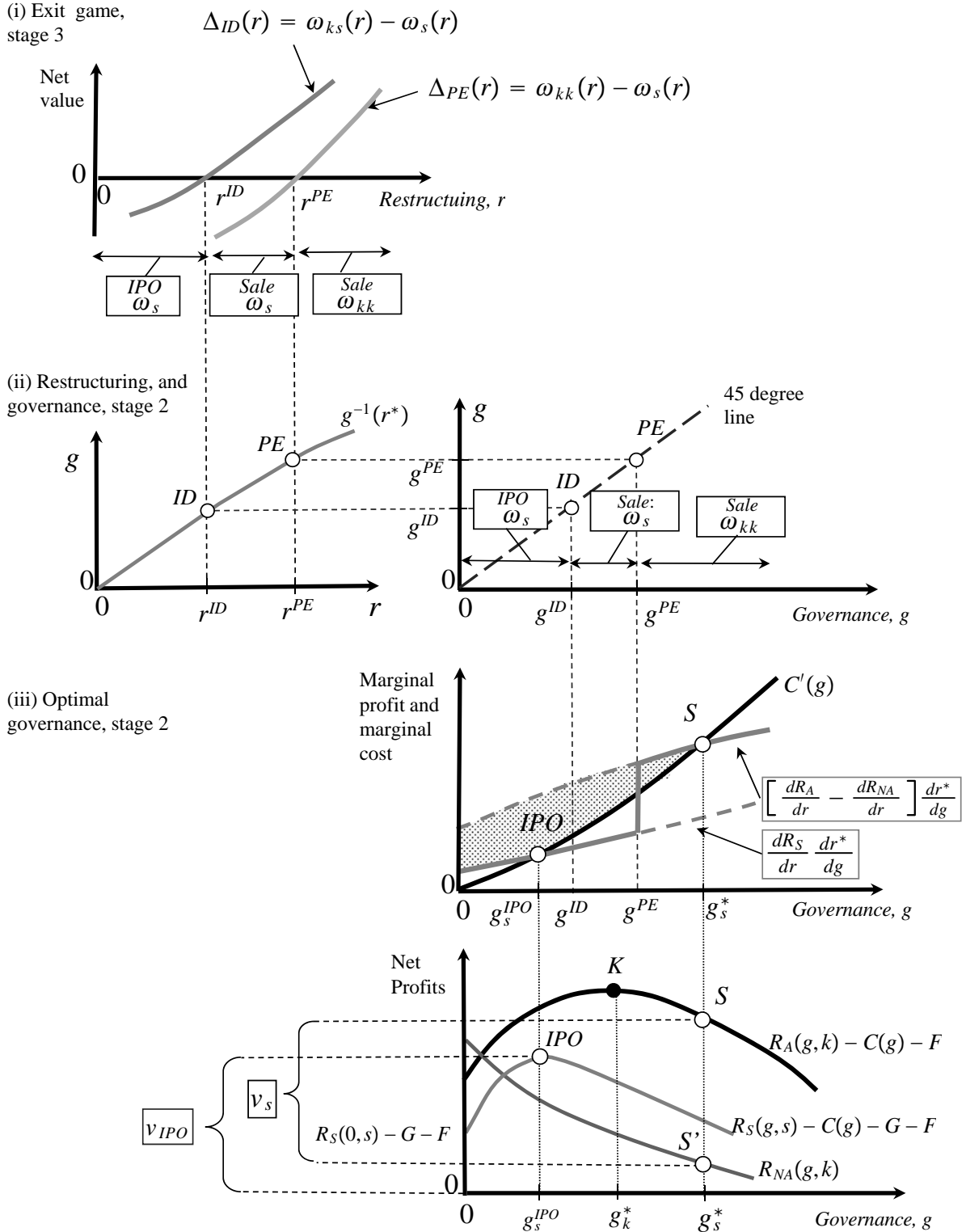
What happens if the level of restructuring increases? Differentiate $\Delta_{ID}(r)$ in r to obtain

$$\frac{d\Delta_{ID}}{dr} = \omega'_{ks,r} - \omega'_{s,r} = \frac{dR_A}{dr} - \frac{dR_{NA}(r,s)}{dr} - \frac{dR_S}{dr} > 0. \qquad (21)$$

An incumbent's value of deterring the outside firm from acquiring the target ($\omega_{ks}(r)$) increases more than the IPO valuation ($\omega_s(r)$) when the level of restructuring increases. From Assumption 2, both the first term in $\omega_{ks}(r) = R_A(r,k) - R_{NA}(r,s)$ as well as the first term in $\omega_s(r) = R_S(r,s) - G$ increases

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[22]Assumption 2 holds when the acquiring incumbent has a larger profit increase from restructuring than the profit increase when the target is placed on the market, $dR_A/dr \geq dR_S/dr$. This is reasonable since often the concentration is higher under incumbent ownership which results in a greater direct effect on costs when restructuring a larger firm (this dominates the standard strategic effect). In the LC-model of Example 1 without synergies from combining the target's assets and the acquiring incumbent's assets (i.e. with $\gamma = 1$ and $c_A = c - r = c_S$), it can be shown that $dR_A/dr \geq dR_S/dr$ holds unless we approach monopoly. If synergies arise (i.e. with $\gamma > 1$ and $c_A = c - \gamma r < c_S$), $dR_A/dr \geq dR_S/dr$ will always hold if such synergies are sufficiently strong. Note, however, that Assumption 2 is milder and allows the profit increase from restructuring to be stronger under an IPO than for under incumbent ownership as long as this difference is not too large.

Figure V: Optimal governance, restructuring and ownership with IPOs.

(i) Exit game,
stage 3

$$\Delta_{ID}(r) = \omega_{ks}(r) - \omega_s(r)$$

$$\Delta_{PE}(r) = \omega_{kk}(r) - \omega_s(r)$$

Net
value

0

r^{ID} r^{PE} *Restructuing, r*

| IPO ω_s | Sale ω_s | Sale ω_{kk} |

(ii) Restructuring, and
governance, stage 2

$g^{-1}(r^*)$

g

PE

ID

g 0 r^{ID} r^{PE} r

g 45 degree line

PE

g^{PE}

ID

| IPO ω_s | Sale: ω_s | Sale ω_{kk} |

g^{ID}

0   g^{ID} g^{PE} *Governance, g*

(iii) Optimal
governance, stage 2

Marginal
profit and
marginal
cost

$C'(g)$

S

IPO

$$\left[\frac{dR_A}{dr} - \frac{dR_{NA}}{dr} \right] \frac{dr^*}{dg}$$

$$\frac{dR_S}{dr} \frac{dr^*}{dg}$$

0   g_s^{IPO} g^{ID} g^{PE} g_s^* *Governance, g*

Net
Profits

K

S

IPO

$R_A(g,k) - C(g) - F$

v_s

$R_S(0,s) - G - F$

$R_S(g,s) - C(g) - G - F$

v_{IPO}

S'

$R_{NA}(g,k)$

0   g_s^{IPO} g_k^* g_s^* *Governance, g*

Notes. Part (i) of this figure illustrates that the exit game in stage three when IPOs are possible. For low restructuring r, IPOs are undertaken while for higher r trade sales take place. Part (ii) illustrates governance intensity maps to restructuring intensity and thus how the exit mode (trade sale or IPO) is affected by governance intensity. Part (iii) displays how optimal governance intensity is set and how this in turns determine valuations in the initial acquisition auction.

in r. However, since the profit of a non-acquirer $R_{NA}(r, s)$ decreases in r, an additional increase in the incumbent's valuation occurs such that $d\omega_{ks}/dr > d\omega_s/dr$. Thus, since an incumbent's net value of deterring an IPO $\Delta_{ID}(r) = \omega_{ks} - \omega_s$ is increasing in restructuring r, an incumbent acquisition at the acquisition price $S^3 = \omega_s(r)$ occurs at $r = r^{ID}$ where $\Delta_{ID}(r^{ID}) = 0$. Other incumbents will not preempt a rival acquisition in the region $r \in (r^{ID}, r^{PE})$, since the net value of preemption is negative $(\Delta_{PE}(r) = \omega_{kk} - \omega_s < 0)$. Hence the private equity firm will exit by a trade sale at the price $S^{3^*} = \omega_s(r)$ in this region.

What if restructuring increases even further? Since restructuring decreases the profit of a non-acquiring incumbent under an incumbent acquisition, the net value of preempting rivals also increases. Differentiating the net value of preemption Δ_{PE} in r we obtain from Assumption 2

$$\frac{d\Delta_{PE}}{dr} = \varpi'_{kk,r} - \varpi'_{e,r} = \frac{dR_A}{dr} - \frac{dR_{NA}(r, k)}{dr} - \frac{dR_S}{dr} > 0. \tag{22}$$

As illustrated in Figure V(i), when restructuring increases into the region $r \in [r^{PE}, r^{\max})$ this leads to a strictly positive net value of preemption: $\Delta_{PE}(r) = \omega_{kk} - \omega_s > 0$. This induces a bidding war between incumbents driving the equilibrium acquisition price above value of undertaking an IPO: $S^{3^*} = \omega_{kk} = R_A(r, k) - R_{NA}(r, k) > \omega_s = R_S(r, k) - G$. The restructured firm is thus exited by a trade sale at the acquisition price $S^{3^*} = \omega_{kk}$.

5.3 Stage 2: Governance and Restructuring

Given the ownership of the target, a manager is hired to conduct restructuring. The utility of the manager is $U(r, g) = w(r, g) - e(r)$ from which we can use equations (4) and (5) to show that the manager's optimal choice of restructuring $r^*(g)$ is increasing in governance, $dr^*/dg > 0$. Define reduced-form profit functions $R_S(g, s) \equiv R_S(r^*(g), s)$, and $R_{NA}(g, s) \equiv R_{NA}^{IPO}(r^*(g), s)$ under exit by an IPO, and $R_A(g, k) \equiv R_A(r^*(g), k)$, and $R_{NA}(g, k) \equiv R_{NA}(r^*(g), k)$ under exit by a trade sale in stage three, or under a direct acquisition by an incumbent in stage one.

Let us now solve for the optimal choice of governance structure. We proceed in three steps. First, we show how the exit mode (IPO or trade sale) depends on the level of governance (g). Second, we find what level of governance is chosen conditional on the exit mode (g_s^* and g_s^{IPO}), adding the cost of implementing the governance structure and undertaking restructuring ($C(g)$). Finally, we determine the optimal exit mode that maximizes the value of an exit.

5.3.1 Exit Mode Given Governance.

From equation (5), the optimal choice of restructuring by the manager $r^*(g)$ is a monotonic and increasing function in the intensity of governance g. We can then use its inverse $g^{-1}(r^*)$ to obtain the cutoffs

$g^{ID} = g^{-1}(r^{ID})$ and $g^{PE} = g^{-1}(r^{PE})$. This is illustrated in the left panel of Figure V(ii). As shown in the right panel of Figure V(ii), these cutoffs allows us to restate Lemma 2 and derive the exit mode and the reward to exit as a function of the level of governance, g. Defining $\omega_s(g) \equiv R_S(g, s) - G$ as the reduced-form reward from exiting through an IPO in stage three, $\omega_{ks}(g) = R_A(g, k) - R_{NA}(g, s)$ as the reduced form IPO-deterring valuation, and $\omega_{kk}(g) = R_A(g, k) - R_{NA}(g, k)$ as the reduced-form preemptive valuation, we have the following Lemma:

Lemma 3. *An IPO takes place if $g \in (0, g^{ED})$ with a reward $\omega_s(g)$ for the private equity firm, a trade sale where the incumbent buyer is driven by deterring an IPO at price $S^3 = \omega_s(g)$ takes place for $g \in [g^{ID}, g^{PE})$ and a trade sale driven by incumbents' incentive to preempt rivals occurs at price $S^3 = \omega_{kk}(g)$ for $g \in [g^{PE}, g^{\max})$.*

5.3.2 Optimal Governance.

Lemma 3 says that under a low level of governance ($g \in (0, g^{ID})$) incumbents willingness to pay is low and therefore an exit by IPO will take place. Adding the cost of restructuring and governance $C(g)$, the optimal governance under an IPO is $g_s^{IPO} = \arg\max_g[\omega_{IPO}(g) - C(g) - (F - \Delta)] = \arg\max_g[R_S(g, s) - C(g) - G - (F - \Delta)]$, with associated first-order condition:

$$\frac{dR_S}{dg} = \frac{dR_S}{dr}\frac{dr^*}{dg} = C'(g_s^{IPO}). \tag{23}$$

This choice is shown in point IPO in the upper panel of Figure V(iii).

A higher level of governance $g \in [g^{ID}, g^{PE})$ leads to an exit by a trade sale where incumbents pay the IPO valuation. In this region, the chosen level of governance is yet again given from equation (23), i.e. $g_S^* = g_s^{IPO}$. In the region $g \in [g^{PE}, g^{\max})$, the private equity firm will choose $g_s^* = \arg\max_g[\omega_{kk}(g) - C(g) - (F - \Delta)] = \arg\max_g[R_A(g, k) - R_{NA}(g, k) - C(g) - (F - \Delta)]$, with the associated first-order condition (7). This is shown in point S in the upper panel of Figure V(iii). From Assumption 2, it follows that $dR_A(g, k)/dg - dR_{NA}(g, k)/dg - dR_S(g, s)/dg > 0$ and from equation (23) and equation (7) we know that $g_s^* > g_s^{IPO}$ holds. Thus, to create bidding competition among incumbents, the level of governance is higher under exit by trade sale than under exit by an IPO ($g_s^* > g^{PE} > g_s^{IPO}$).

Proposition 4. *The level of governance and restructuring is higher under exit by trade sale than under exit by an IPO: $g_s^* > g_s^{IPO}$ and $r^*(g_s^*) > r^*(g_s^{IPO})$.*

5.3.3 Optimal Exit Mode.

The optimal exit mode is now the one that maximizes the net value of an exit. To proceed, define the net value of doing an IPO as

$$v_{IPO} = R_S(g_s^{IPO}, s) - C(g_s^{IPO}) - (F - \Delta), \, g \in [g^{ID}, g^{PE}). \tag{24}$$

The value of a doing an exit by trade sale is then:

$$v_S = \begin{cases} R_S(g_s^{IPO}, s) - C(g_s^{IPO}) - (F - \Delta) & \text{if } g_S^* \in [g^{ID}, g^{PE}) \\ R_A(g, k) - R_{NA}(g, k) - C(g) - (F - \Delta) & \text{if } g_S^* > g^{PE} \end{cases}. \tag{25}$$

To illustrate the choice of exit mode, suppose that $g_S^* > g^{PE}$ as shown in Figure V(iii). Solve for the highest IPO cost G consistent with IPO as exit mode. Using equation (24) and equation (25) in $v_S = v_{IPO}$ we obtain the exit condition

$$\bar{G} \equiv \left[R_S(g_s^{IPO}, s) - C(g_s^{IPO}) \right] - [R_A(g_s^*, k) - R_{NA}(g_s^*, k) - C(g_s^*)]]. \tag{26}$$

The left-hand side shows the maximum IPO cost consistent with exit by IPO. Since $C(0) = 0$, it follows that

$$R_S(g_s^{IPO}, s) - C(g_s^{IPO}) = R_S(0, s) + \int_0^{g_s^{IPO}} [dR_S(g, s)/dg - C'(g)] \, dg. \tag{27}$$

Moreover, $R_A(0, k) = R_{NA}(0, k)$ implies

$$R_A(g_s^*, k) - R_{NA}(g_s^*, k) - C(g_s^*) = \int_0^{g_s^*} [dR_A(g, k)/dg - dR_{NA}(g, k)/dg - C'(g)] \, dg. \tag{28}$$

Equation (26) can then be written as

$$\int_0^{g_s^{IPO}} \underbrace{\left[\frac{dR_A(g,k)}{dg} - \frac{dR_S(g,s)}{dg} - \frac{dR_{NA}(g,k)}{dg} \right]}_{(+)} dg + \tag{29}$$

$$\int_{g_s^{IPO}}^{g_s^*} \underbrace{\left[\frac{dR_A(g,k)}{dg} - \frac{dR_{NA}(g,k)}{dg} - C'(g) \right]}_{(+)} dg = R_S(0, s) - G.$$

The first term on the right hand side shows the level of profits that can be made under IPO without inducing restructuring through improved governance. The left hand side shows how much profits could be increased by the stronger governance chosen under exit by trade sale with bidding competition between incumbents, $(g_S^* > g_S^{IPO})$. The first term shows the increment in profit from obtaining a higher marginal revenue in a trade sale for the level of governance associated with an IPO (g_s^{IPO}). The second term

adds the increase in the profit from investing additionally in restructuring by choosing the higher level of governance in a trade sale ($g_s^* > g_s^{IPO}$). Thus, an exit by trade sale is more likely the larger is the level of governance in a trade sale relative to an IPO. The sum of these two terms is shown by the shaded areas in Figure V(iii).

In terms of empirical predictions, we can note the following. If Assumption 2 holds, if $g_s^* > g^{PE}$, and if a private equity firm has acquired the target in stage one, then the private equity firm will exit by trade sale when IPO costs are high, the marginal cost of governance is low and when governance (and subsequent restructuring) can significantly affect the target's as well as rival firm's net profits. Moreover, buyouts with little performance improvements in the target should predominately occur when exit takes place by an IPO.

5.4   Stage 1: The Acquisition Auction

We are now set to solve the acquisition auction in stage one when private equity firms can exit in stage three by a trade sale or IPO. Due to the bidding competition, private equity firms will always bid $\max(v_{IPO}, v_s)$, and upon winning, exit in stage three with the exit mode that gives the highest reward. The optimal buyout mode for private equity firms in stage one is then

$$
l = \begin{cases} s & \text{if } v_s > v_{IPO} \\ IPO & \text{if } v_s \leq v_{IPO} \end{cases}. \tag{30}
$$

This will be anticipated by incumbents. We then complete our set of valuations (v_s, v_{kk}, v_{ks} and v_{IPO}) to include an incumbent's value of deterring a subsequent exit by IPO:

$$
v_{kIPO} = R_A(g_k^*, k) - C(g_k^*) - F - R_{NA}(g_s^{IPO}, s). \tag{31}
$$

We then have the following Lemma that solves for the equilibrium ownership structure and the acquisition prices in stage one.

Lemma 4. *The equilibrium ownership and the acquisition price S^1 in stage one is given in Table I.*

Proof. See the appendix. □

This Lemma follows from comparing the valuations. It is always the owner with the highest valuation that acquires the target and the acquisition price is set just above the second highest bidders valuation. From Lemma 4 and Proposition 4, we have the following proposition:

Proposition 5. *Buyouts exited through IPOs can occur in equilibrium when buyouts exited through trade sales would be preempted by incumbents.*

26

Table I: Equilibrium ownership structure and the acquisition price with IPOs

For $l \in \{s, IPO\}$ in equation (30):			
Inequality	Definition	Winning type	Acquisition price, S^1
$I1$	$v_{kk} > v_{kl} > v_l$	k	v_{kk}
$I2$	$v_{kk} > v_l > v_{kl}$	k or l	v_{kk}, v_l
$I3$	$v_{kl} > v_{kk} > v_l$	k	v_{kk}
$I4$	$v_{kl} > v_l > v_{kk}$	k	v_l
$I5$	$v_l > v_{kk} > v_{kl}$	l	v_l
$I6$	$v_l > v_{kl} > v_{kk}$	l	v_l

Notes. This table describes the equilibrium ownership type (k or l) and the acquisition price S^1 for each possible ranking of the valuations v.

To prove Proposition 5, let us derive the smallest advantage in fixed restructuring cost needed to have an IPO ($\tilde{\Delta}$). From the IPO-condition ($v_{IPO}(\tilde{\Delta}) \equiv v_{kIPO}$) we obtain:

$$\tilde{\Delta} = R_A(g_k^*, k) - C(g_k^*) - R_{NA}(g_s^{IPO}, s) - \left[R_S(g_s^{IPO}, s) - C(g_s^{IPO}) - G \right]. \tag{32}$$

Let us compare $\tilde{\Delta}$ to the smallest restructuring advantage needed to have a buyout for trade sale ($\bar{\Delta}$) defined in the preemption condition $v_{ks} = v_s(\bar{\Delta})$ from equation (12). This gives, after some manipulation,
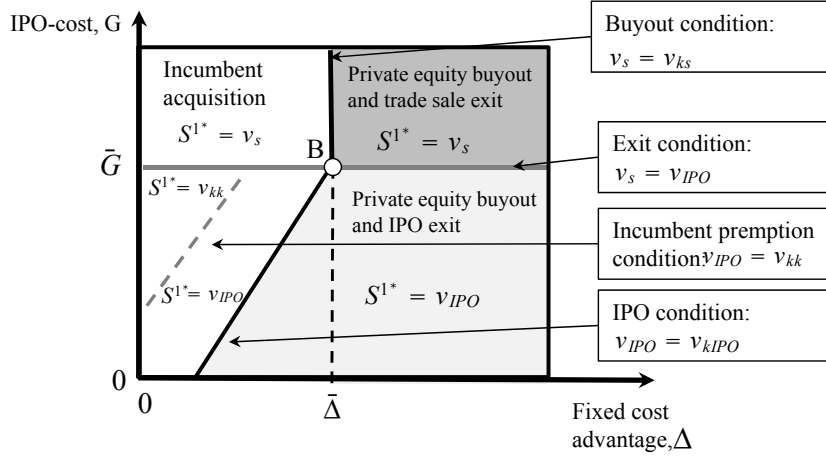
$$\bar{\Delta} - \tilde{\Delta} = v_{IPO} - v_s + R_{NA}(g_s^{IPO}, s) - R_{NA}(g_s^*, s). \tag{33}$$

To get a feel for how the equilibrium ownership structure is determined, consider Figure VI, which depicts the equilibrium ownership structure over the space of the fixed cost advantage of private equity firms $\Delta \geq 0$ and the fixed IPO cost $G \geq 0$. The horizontal locus $\bar{G}$ is the exit condition (with $\bar{G} > 0$ assumed), defined from $v_s = v_{IPO}$ in equation (26). For $G < \bar{G}$, the private equity firm will exit by an IPO in stage three, whereas for $G \geq \bar{G}$ the exit takes place by a trade sale.

Consider first the region where exit would take place through a trade sale ($G \geq \bar{G}$). The vertical locus $\bar{\Delta}$ is the preemption condition and again shows the fixed costs advantage required by private equity firms just to outbid incumbents ($v_s = v_{ks}$). For $\Delta > \bar{\Delta}$ a private equity firm will outbid the incumbents and hence in the North-East region in Figure VI, the target is acquired in stage one by a private equity firm paying the price $S^{1*} = v_s$ (followed by an exit by a trade sale). In the North-west-region, where $\Delta \leq \bar{\Delta}$, an incumbent preempts private equity firms in stage one paying the price $S^{1*} = v_s$.

Consider then IPO costs low enough to generate exits by IPO in stage three ($G < \bar{G}$). The first term in equation (33) must be positive because $G < \bar{G}$ implies $v_{IPO} > v_s$. Then, from Proposition 4, exit by a trade sale implies a stronger governance structure than exit by IPO ($g_s^* > g_s^{IPO}$). It follows that if $g_s^* - g_s^{IPO}$ is sufficiently large, a non-acquiring incumbent is worse off under a trade sale despite the lower concentration under an IPO ($R_{NA}(g_s^{IPO}, s) > R_{NA}(g_s^*, s)$). But then $\bar{\Delta} > \tilde{\Delta}$ such that a smaller advantage is required under an IPO to outbid incumbents. Thus, buyouts for IPO meet less resistance

Figure VI: The Ownership equilibrium in stage one of the generalized model.

from incumbents than buyouts for trade sale. This can also be seen in Figure VI noting that the locus for the IPO condition which is the upward sloping line which intersects $\Delta-$axis at $\tilde{\Delta}(0) < \bar{\Delta}$. Below both the IPO and exit condition, the target will be acquired by a private equity firm at the price $S^{1^*} = v_{IPO}$. Since the IPO condition is upward sloping it follows that an IPO can occur when trade sales would be preempted even for positive IPO costs (G). Above the IPO condition but below the exit condition, the target would be acquired by an incumbent. The price is either v_{IPO} or v_{kk} depending on which is greater.

Intuitively, Proposition 5 underscores that private equity buyouts that preserve competition in the market meet less resistance from incumbents than private equity buyouts that lead to a concentration in the industry. The natural tendency towards preserving the number of firms in the industry comes from the overinvestment incentives private equity firms face. Incumbents realize that if the buyout will lead to an IPO instead of to a trade sale, reducing the number of firms in the industry, overinvestment incentives will be lower and hence they will have less to fear from letting a private equity firm acquire the target.

6 Antitrust Policy

In most countries the market for corporate control in concentrated markets is scrutinized by an anti-trust authority. When evaluating a merger, antitrust authorities in most jurisdictions estimate whether efficiency gains are likely to offset the higher market power enjoyed by the merging firms, or not. According to the US Merger Guidelines by the US Department of Justice, they ". . .*will not challenge a merger if cognizable efficiencies are of a character and magnitude such that the merger is not likely to be anticompetitive in any relevant market. To make the requisite determination, the Agency considers whether*

cognizable efficiencies likely would be sufficient to reverse the merger's potential to harm consumers in the relevant market, e.g. by preventing price increases in that market."[23] This corresponds to the antitrust authority maximizing consumer surplus. Following Motta and Vasconcelos (2005) and Fumagalli et al. (2009), suppose that the antitrust authority is forward looking such that it considers whether other mergers could occur if a merger is blocked or allowed and that it accounts for the implications of such alternative mergers on consumer surplus.[24]

We can state the following proposition:

Proposition 6. *With a forward looking consumer welfare maximizing antitrust authority, the emergence of an active private equity market can increase consumer welfare through*

(i) triggering otherwise unprofitable but consumer welfare enhancing mergers; or through

(ii) helping to preserve competition in the market.

To see the first part of Proposition 6, consider the target's decision to sell. Suppose that the target cannot profitably restructure itself but that it can now choose to remain on the market. If the target is not sold it obtains the profit $R_T(0,t) = \Pi_0(\mathbf{x}_0^*(0), 0, t) > R_T(g_t^*, t) - C(g_t^*) - F_t$ where $g_t^* = \arg\max_g[R_T(g,t) - C(g) - F_t]$. The profit for incumbent rivals are $R_{NA}(0,t) = R_T(0,t)$. The target will never sell its assets for a lower price than $v_t = R_T(0,t)$, which is now the reservation price of the target. Bidding competition between symmetric private equity firms implies that private equity firms always bid $max\{v_s, v_{IPO}\}$. The acquisition game in stage one can then be solved by applying Lemma 4 and replacing equation (30) with

$$
l^* = \begin{cases} s & \text{if } v_s > \max\{v_{IPO}, v_t\} \\ IPO & \text{if } v_{IPO} > \max\{v_s, v_t\} \\ t & \text{if } v_t > \max\{v_s, v_{IPO}\} \end{cases} \tag{34}
$$

Use $CS(g,l) \equiv CS(r^*(g), l)$ to denote the reduced-form consumer surplus, where $l = \{s, k, t\}$ denotes the ownership of the target, and where $r^*(g)$ is, again, the optimal restructuring undertaken by the manager in the target under a given level of governance. The choice by an incumbent is $g = g_k^*$, while $g = g_s^{IPO}$ and $g = g_s^*$ are the choices by a private equity firm exiting by IPO and trade sale. Again, better governance increases consumer welfare $(dCS/dr)(dr^*/dg) > 0$. Consumer surplus is also increasing in the number of firms active in the market.

Suppose that there is initially no private equity sector active. This could be because the private equity firms do not have sufficient restructuring advantages (Δ low) or that IPO costs are high (G high). Private

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[23] US Merger Guidelines, revised April 8, 1997, Section 4.

[24] Nocke and Whinston (2010) details under what circumstances a myopic antitrust authority does equally well as a forward-looking one. The conditions under which this occurs are not fulfilled in our setting because firms could be involved in multiple mergers (the set of mergers is not disjoint) and because of heterogeneity in ownership types (private equity firms maximize the trade sale price, which gives different incentives for mergers compared to maximizing product market profits).

equity firms cannot then outbid the target: $v_t > \max\{v_s, v_{IPO}\}$. An acquisition by an incumbent of the target is the only possible merger and will be allowed by the antitrust authority if $CS(g_k^*, s) > CS(0, t)$.

The merger will not, however, take place if the initial market structure is merger stable: if $v_t > v_{kIPO} > v_{kk}$. While the antitrust authority can block consumer welfare reducing mergers, it cannot force firms to merge when the merger is beneficial for consumers but is not privately profitable (as pointed out by Salant et al. (1983)). Private equity firms can alleviate this problem by threatening to buy the target. To see this, suppose that an active private equity market develops such that $\Delta = 0$ and the IPO cost is slightly above $\bar{G}$ so $v_s > v_{IPO}$ holds. Private equity firms will then bid higher than the reservation price of the target. Incumbents will anticipate that private equity firms will use strong governance structures to induce restructuring in stage two to create bidding competition in a trade sale in stage three. From Proposition 2, an incumbent then has an incentive to preempt such overinvestment since $v_{ks} > v_s$. Hence, the mere threat of a private equity buyout is enough to trigger the otherwise privately unprofitable merger.

To see the second part of Proposition 6, note that while the antitrust authority will recognize that an incumbent acquisition can increase consumer welfare compared to no acquisition taking place $(CS(g_k^*, s) > CS(0, t))$, it will also infer that consumer welfare could be further improved by encouraging a buyout and meddling with the exit auction. Encouraging trade sales has the benefit of ensuring stronger incentives to improve governance and conduct restructuring. Indeed, under a trade sale $CS(g_s^*, k) > CS(g_k^*, k)$ follows directly since private equity firms maximize the sales price. Encouraging IPOs, on the other hand, has the benefit of ensuring that the number of firms in the industry stays constant. An active private equity market can then help prevent concentration in the market while still ensuring that governance is improved and restructuring is undertaken. Which exit mode the antitrust authority prefers will depend on whether the benefit to consumers from overinvestment under trade sales outweighs the benefit to consumers of preventing concentration in the market under an IPO.

7   Incentives to Specialize

Before concluding the paper, let us close the baseline model by showing that temporary ownership provides incentives for specializing in restructuring because restructuring can be undertaken in several markets. To endogenize Δ, we add a stage zero to our baseline model with trade sales. In this stage, incumbents and private equity firms can invest in acquiring restructuring skills by increasing the fixed restructuring cost advantage Δ. The incumbents and the private equity firms choose simultaneously whether to retain the fixed restructuring cost F, or to invest in acquiring specialized restructuring skills at cost Ψ providing fixed restructuring costs of $F - \Delta$. Private equity firms participate in the bidding of targets in d separate markets which are segmented on the demand side. Incumbents face costs in

Table II: Payoff matrix for specializing in restructuring.

	Abstain $(\Delta_k = 0)$		*Invest* Ψ $(\Delta_k = \Delta)$	
Abstain $(\Delta_s = 0)$	$\pi_s(0,0)$	$\pi_k(0,0)$	$\pi_s(0,\Delta)$	$\pi_k(\Delta,0)$
Invest Ψ $(\Delta_s = \Delta)$	$\pi_s(\Delta,0)$	$\pi_k(0,\Delta)$	$\pi_s(\Delta,\Delta)$	$\pi_k(\Delta,\Delta)$

Notes. This table displays the pay-off matrix depicting a private equity firm's investment strategy horizontally and an incumbent's investment strategy vertically.

learning how to produce in new markets and only participate in the bidding over a target in their own market (such costs are avoided by private equity firms since they buy to sell and do not remain in the market). We obtain the following proposition.

Proposition 7. *There exists a unique equilibrium in which only private equity firms invests in acquiring restructuring skills in stage zero if the number of markets d with potential targets is sufficiently high: if* $\Psi > \Delta > \overline{v}_{ks} - \overline{v}_s + \Psi/d$.

To see this, consider a situation where one private equity firm and one incumbent chooses between investing and not investing. Other private equity firms will not invest if they believe that a rival private equity firm, or an incumbent, will invest as they cannot cover the investment cost from the resulting bidding competition over the target. Assuming that the fixed cost advantage from investing is not too large, incumbents will not challenge a rival incumbent acquisition in stage one due to the free-riding effect of an acquisition. Then, incumbents have no incentive to invest given that a rival incumbent invests.

Table II depicts the net profits of the incumbent (k) and the private equity firm (s), given that other private equity firms and incumbents choose not to invest. Let us examine when {*Invest, Abstain*} is a unique equilibrium, i.e. under what conditions does the private equity firm s choose "Invest" and the incumbent k choose "Abstain".

Suppose the private equity firm choose to invest if the incumbent chooses not to invest. When only one private equity firm invests, the acquisition price is $S^1 = v_{ks} = \overline{v}_{ks} - F$, where we use a bar to denote stage one valuations gross of fixed restructuring costs. The net profit for the private equity firm is then $\pi_s(\Delta,0) = \overline{v}_s - (F - \Delta) - S^1 - \Psi/d$, where the investment cost Ψ is spread out on each market with a potential target. Without investing the private equity firm cannot outbid the incumbent, $\pi_s(0,0) = 0$. The private equity firm will then choose to invest if $\pi_s(\Delta,0) - \pi_s(0,0) > 0$, or if

$$\Delta > \overline{v}_{ks} - \overline{v}_s + \frac{\Psi}{d} = \bar{\Delta} + \frac{\Psi}{d}. \tag{35}$$

Intuitively, the fixed cost reduction in restructuring must be greater than the per market investment cost Ψ/d and the incentive for the incumbent to preempt overinvestment in restructuring in a future

Figure VII: Specialization in equilibrium.
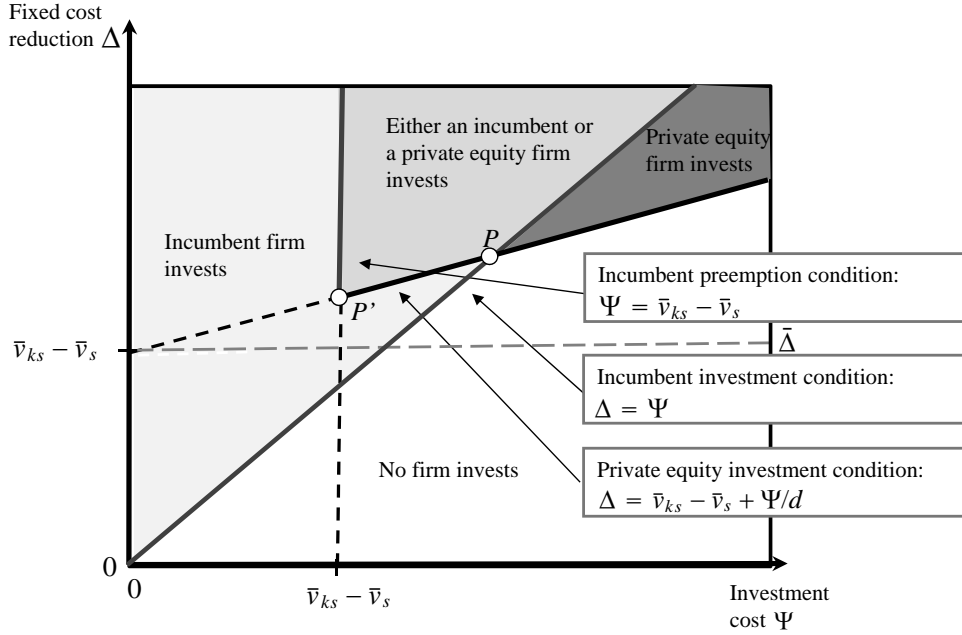
Notes. This figure illustrates the solution to the stage zero investment game for different values of the cost of specializing in restructuring (Ψ) and the fixed restructuring cost (F). The more markets d private equity firms can invest in, the more likely it is that a unique equilibrium exists in which only private equity firms invest in acquiring specialized restructuring skills.

trade sale ($\bar{\Delta} = \bar{v}_{ks} - \bar{v}_s$ from Proposition 2). Above the locus $\Delta = \bar{v}_{ks} - \bar{v}_s + \Psi/d$ labeled the private equity investment condition in Figure VII, the private equity firm has an incentive to invest, given that the incumbent does not invest. If the incumbent would invest, the private equity firm cannot outbid the incumbent in the acquisition game in stage one and would therefore make a loss on investing: $\pi_s(\Delta, \Delta) = -\Psi/d$.

Let us now examine when "Abstain" is a dominating strategy for the incumbent, starting with the incumbents incentive to preempt an investment by the private equity firm. The incumbent needs to pay the valuation of the private equity firm in stage one ($S^1 = v_s = \bar{v}_s - (F - \Delta)$) which gives a net profit of $\pi_k(\Delta, \Delta) = R_A(g_k^*) - C(g_k^*) - (F - \Delta) - S^1 - \Psi$. If the incumbent abstains, a buyout will occur, and its net profit becomes $\pi_k(0, \Delta) = R_{NA}(g_s^*)$. Consequently, the incumbent will not preempt the investment by the private equity firm if $\pi_k(0, \Delta) > \pi_k(\Delta, \Delta)$, or if:

$$\Psi > \bar{v}_{ks} - \bar{v}_s = \bar{\Delta} \tag{36}$$

To the right of the locus $\Psi = \bar{\Delta}$, labeled the incumbent preemption condition in Figure VII, the incumbent will not invest when the private equity firm has invested. Intuitively, the incumbent abstains if the incentive to preempt excessive restructuring is smaller than the investment cost.

Examine next the incumbent's incentive to invest if that the private equity firm chooses not to invest. Then, an incumbent acquisition occurs in stage one at the valuation of the private equity firm:

$S^1 = v_s = \overline{v}_s - F$. It follows that net profit for the incumbent when investing is $\pi_k(\Delta, 0) = R_A(g_k^*) - C(g_k^*) - (F - \Delta) - S^1 - \Psi$, whereas the net profit when not investing is $\pi_{k_1}(0, 0) = R_A(g_k^*) - C(g_k^*) - F - S^1$. Consequently, the incumbent will not invest if $\pi_k(0, 0) > \pi_k(\Delta, 0)$, which corresponds to

$$\Psi > \Delta. \tag{37}$$

The locus $\Psi = \Delta$ is labeled the incumbent investment condition and also shown in Figure VII. The figure reveals that four types of equilibria can occur.

When investing into restructuring skills is relatively cheap (Δ/Ψ high) only the incumbent invests. When the cost of investing is relatively high (Δ/Ψ low) no firm invests. When both the reward to investing Δ and the cost to investing Ψ are fairly high multiple equilibria emerge. The equilibrium where *only* the private equity firm invests {*Invest, Abstain*}, emerges in the North-East region, below the incumbent investment condition and above the private equity investment condition. Intuitively, investment costs need to be sufficiently high to decrease the incentive for the incumbent to invest, while the reward in cost reduction cannot be too high as this would create too strong an incentive for the incumbent to invest. An essential element is that the number of markets d needs to be sufficiently large to have only the private equity firm investing in equilibrium. With only one market the private equity investment locus in equation (35) would be parallel to the incumbent investment condition locus in equation (37). Then, only the region of multiple equilibria where either the private equity firm or the incumbent invests exist.

8 Concluding remarks

We have developed a theory of temporary ownership in oligopolistic markets underscoring three properties of temporary ownership. First, temporary ownership leads to *overinvestment* in governance and restructuring efforts relative to permanent ownership. Overinvestment increases consumer surplus but reduces producer surplus. Second, temporary owners can aid antitrust authorities in maximizing consumer surplus by *triggering mergers* in a merger stable industry or by *preventing concentration* in the industry. Third, temporary ownership gives incentives for *specialization* in temporary ownership.

Our analysis suggests that private equity firms fill an important role as challengers of existing oligopolies through aggressive restructuring of firms up for sale. We also underscore the important role played by antitrust authorities in ensuring that an active private equity market benefits consumers.

An interesting avenue for future work is empirical testing of how product market effects interact with temporary ownership. Studies of demonstrating the importance of product market effects, such as Kovenock and Phillips (1995) and Hsu et al. (2010), are an excellent start but more work on how exit and investment decisions are influenced by product market effects would be welcome.

APPENDIX

A   Extensions

A.1   The differentiated product multi-plant model

Here we give another example of a product market model that fulfills Assumption 1. Let each firm initially own and produce one product. Let the inverse demand of a product be $P_j = a - q_j - \tau q_{-j}$, in which $\tau \in [0,1]$ is the degree of product substitutability ($\tau = 0$ implies a monopoly and $\tau = 1$ implies homogenous goods), q_j is the output of product j and q_{-j} is the output of the other products. The product market profit for a firm with product j is $\Pi_j = (P_j - c_j)q_j$. Dividing up in firm types, marginal costs are (without synergies):

$$c_A = c - \bar{k}, \qquad c_N = c - \bar{k}, \qquad c_T = c - r, \tag{38}$$

where c_T is the marginal cost of the target and $\bar{k}$ represents firm-specific assets. The acquirer will now own two products (its own product and the target's product). The Nash-Cournot equilibrium $\mathbf{q}^* = (q_h^*, q_{-h}^*)$ is then determined from the first-order conditions $\frac{\partial(\Pi_A + \Pi_T)}{\partial q_T} = 0$ and $\frac{\partial(\Pi_A + \Pi_T)}{\partial q_A} = 0$ for the acquirer, and $\frac{\partial \Pi_N}{\partial q_N} = 0$ for a non-acquirer. We can then define $R_A = [P_A(\mathbf{q}^*) - c_A] q_A^* + [P_T(\mathbf{q}^*) - c_T] q_T^*$ as the associated reduced-form profit function for the acquirer and $R_N = [P_N(\mathbf{q}^*) - c_N] q_N^*$ as the reduced-form profit function for a non-acquirer. The differentiated product multi-plant model can also be solved for Bertrand competition. The inverse demand function in $P_j = a - q_j - \tau q_{-j}$ is inverted into direct demand, $q_j(\mathbf{p}, \eta)$, with $\mathbf{p} = (p_j, p_{-j})$. Dividing into firm types, the direct profit is $\Pi_h = (p_h - c_h)q_h(\mathbf{p})$. Let $\mathbf{p}^* = (p_h^*, p_{-h}^*)$ be the Nash-Bertrand equilibrium from the first-order conditions $\frac{\partial(\Pi_A + \Pi_T)}{\partial p_T} = 0$ and $\frac{\partial(\Pi_A + \Pi_T)}{\partial p_A} = 0$ for the acquirer, and $\frac{\partial \Pi_N}{\partial p_N} = 0$ for a non-acquirer. From these conditions we can define $R_A = [p_A^* - c_A] q_A(\mathbf{p}^*) + [p_T^* - c_T] q_T(\mathbf{p}^*)$ and $R_N = [p_N^* - c_N] q_N(\mathbf{p}^*)$ as the associated reduced-form profit functions. Assumption 1 holds for these profit functions.

A.2   Managerial Ownership Combined with a Fixed Wage

In stage two above we provided managerial ownership as an example of a governance structure. But what if the manager is offered both a fixed wage b and a share g of the firm? Suppose that the managers utility function is $u(W(b,g), r) = -e^{-\eta[W(b,g) - e(r)]}$ in which η measures the degree of risk aversion. The restructuring effort undertaken by the manager is observed but is not verifiable and cannot be contracted on. The manager is therefore offered a linear contract $\{b, g\}$ consisting of a fixed wage b and a share g of the product market profits net of restructuring costs: $W(b,g) = b + g[R_A(r) - F]$. The restructuring costs for the firm are uncertain and given by $F - \lambda$, with $\lambda \sim N(0, \sigma^2)$. We need to have profits net of

restructuring costs now to ensure that the manager bears the risk associated with restructuring.

Consider the manager's decision on how much restructuring (r) to undertake given the contract $\{b, g\}$. The manager exerts an effort to restructure the target by maximizing expected utility $\mathrm{E}[u(W(b,g),r)] = -e^{-\eta[W(b,g)-e(r)]}\mathrm{E}[e^{-\eta\mu\lambda}]$. We can separate out the stochastic term λ, and since $\lambda \sim N(0, \sigma^2)$ it follows that $\mathrm{E}[e^{-\eta g\lambda}] = e^{-\eta^2 g^2 \frac{\sigma^2}{2}}$. Defining $\Omega(g) = \eta g^2 \frac{\sigma^2}{2}$ as the risk premium given to the manager, it follows that the optimal restructuring is defined as

$$r^* = \arg\max_r \mathrm{E}[u(W(b,g),r)] = \arg\max_r [b + g[R_A(r) - F] - \Omega(g) - e(r)]. \tag{39}$$

It is now apparent that this is just a special case where $w(r,g) = b + g[R_A(r) - F] - \Omega(g)$. Since $w''_{rg} = R'_A(r) > 0$, we have $dr^*/dg > 0$.

So how does the cost function for the governance structure g look? The optimal fixed wage b^* can be pinned down from the participation constraint $W(b^*, g) - e(r^*(g)) - \Omega(g) = \bar{w}$. Hence, the wage to pay as a function of g is $W(b^*, g) = \bar{w} + e(r^*(g)) + \Omega(g)$. The cost of governance can then be rewritten as $c(g) = \bar{w} + e(r^*(g)) + \Omega(g)$ with $dc(g)/dg = e'(r^*(g))dr^*/dg + \Omega'(g) > 0$. The rest of our results then follow.

A.3   Incentive Contracts on the Trade Sale Price

In stage two above, we provided managerial ownership as an example of a governance structure. However, the assumption was that both private equity firms and incumbents offer the manager a share of product market profits. This enables us to compare the intensity of the compensation contract for the two ownership types. It is also consistent with many contracts used in practice as managers in private equity backed firms are often required to remain with the target (or are forced to keep their stocks in the firm) post exit to reduce problems associated with, 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. We then have the following situation:

- Buyout in stage one: $w^s(r,g) = g(R_A(r) - R_{NA}(r))$, with $w^{s''}_{rg} = R'_A(r) - R'_{NA}(r) > 0$ and $dr^*_s/dg > 0$. The cost for the private equity firm is $c^s(g) = g[R_A(r^*(g)) - R_{NA}(r^*(g))]$ with $dc^s(g)/dg = g[\frac{dR_A}{dr} - \frac{dR_A}{dr}]\frac{dr^*}{dg} + [R_A(r^*(g)) - R_{NA}(r^*(g))] > 0$. We have $C^s(g) = c^s(g) + k(r(g))$, with $dC^s/dg > 0$.

- Incumbent acquisition in stage one: $w^k(r,g) = gR_A(r)$, with $w^{k''}_{rg} = R'_A(r) > 0$ and $dr^*_k/dg > 0$. The cost for the incumbent is $c^k(g) = gR_A(r^*(g))$ with $dc^k(g)/dg = g\frac{dR_A}{dr}\frac{dr^*}{dg} + R_A(r^*(g)) > 0$. We have $C^k(g) = c^k(g) + k(r(g))$, with $dC^k/dg > 0$.

Since it now holds that $w^s(r, g) \neq w^k(r, g)$ and $C^s(g) \neq C^k(g)$ it need not be that $g_s^* > g_k^*$ and $r_s^*(g_s^*) > r_k^*(g_k^*)$ holds. To see this, note first that $w_{rg}^{s\prime\prime} > w_{rg}^{k\prime\prime} > 0$. This says that the manager in a private equity backed firm receiving a share of the trade sale price responds more strongly to an increase in governance than a manager in an incumbent acquisition (and that both managers respond to increased governance by increasing restructuring activities). This opens the possibility that a private equity firm can not implement as strong governance measures to induce restructuring because the manager responds more strongly simply because he or she is getting a share of the trade sale price. It is thus possible to have $g_s^* < g_k^*$, but $r_s^*(g_s^*) > r_k^*(g_k^*)$. In general, this occurs if g_k^* determined implicitly from the first-order condition under an incumbent acquisition:

$$\frac{dR_A}{dr} \frac{dr_k^*}{dg} = \frac{dC^k(g_k^*)}{dg} \tag{40}$$

is larger than g_s^* determined from the first-order condition under a private equity buyout:

$$\left[\frac{dR_A}{dr} - \frac{dR_{NA}}{dr} \right] \frac{dr_g^*}{dg} = \frac{dC^s(g_s^*)}{dg}. \tag{41}$$

Thus, private equity firms always induce more restructuring than incumbents ($r_s^*(g_s^*) > r_k^*(g_k^*)$), but if the contract to the manager is on the trade sale price, private equity firms need not necessarily implement stronger governance structures to induce more restructuring ($g_s^* \lesseqgtr g_k^*$).

A.4   Exogenous Variable Restructuring Cost Advantages

Suppose now that private equity firms not only have an advantage Δ in fixed restructuring costs, but that they also have an advantage in variable restructuring costs such that $k_s'(r) < k_k'(r)$. This implies that we have $C^k(g) = c(g) + k_k(r^*(g))$ and $C^s(g) = c(g) + k_s(r^*(g))$, with $dC^k/dg > dC^s/dg > 0$.

If private equity firms have lower variable costs of restructuring, they have even stronger incentives to improve the governance structure, as g_k^* is determined implicitly from $(dR_A/dr)(dr^*/dg) = dC^k/dg$ and g_s^* from $[dR_A/dr - dR_{NA}/dr](dr^*/dg) = dC^s/dg$. Hence, we still have that $g_s^* > g_k^*$ and $r^*(g_s^*) > r^*(g_k^*)$.

But even absent strategic product market effects on the trade sale price, private equity firms will now choose stronger governance structures and induce more restructuring. Second, in the same way as fixed variable cost advantages counteracts the preemptive acquisition motive incumbents have, variable cost advantages in restructuring will allow private equity firms to outbid incumbents in the initial acquisition auction in stage one even absent any fixed cost advantage Δ.

A.5 Incumbents Buying to Sell

Our model assumes that incumbents buy firms to keep them, whereas private equity firms buy firms to sell them. Would our results still hold if incumbents could imitate private equity firms and also buy to sell? Suppose that an incumbent acquired the target in stage one and that the incumbent attempts to sell the restructured firm to a competitor. From Lemma 1, we know that the trade sale price in stage three is $S^3 = R_A(r) - R_{NA}(r)$. We also know the profits from competing with a rival who possesses the target are $R_{NA}(r)$. Thus, the total profits from selling the target and remaining in the industry would be $S^3 - F + R_{NA}(r)$ or $R_A(r) - R_{NA}(r) - F + R_{NA}(r) = R_A(r) - F$. But then it is clear that an incumbent buying to sell implements the same governance structure as an incumbent buying to keep ($g_k^* = \arg\max_g[R_A(g) - C(g) - F]$) and Propositions 1 and 2 still hold. Essentially, the incumbent buying to sell internalizes the effect on its other assets when determining the governance structure leading to the same restructuring intensity as an incumbent buying to keep.

But cannot the incumbent sell *all* of 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 (see Salant et al. (1983)). In our setting, a full exit by an incumbent committed to sell occurs if the following condition holds:

$$\underbrace{R_A(g_s^*; n-1) - R_{NA}(g_s^*; n-1) - C(g_s^*) - F}_{\text{Profits from selling and exiting (with concentration effect), } v_s} > \underbrace{R_A(g_k^*; n) - C(g_k^*)}_{\text{Profits from staying}}, \tag{42}$$

An exit leads to a concentration of the market since there are only $n-1$ incumbents remaining in the market. In general, the sign of equation (42) depends on merger and market-specific characteristics such as level of concentration in the market and asset complementarities. For example, if the asset complementarities 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.

A.6 Non-acquirers can Restructure their Assets

Overinvestment incentives in the baseline model will remain if we allow non-acquirers to invest in restructuring and replace Assumption 1 with the following assumption:

Assumption 3. *Restructuring activities are strategic substitutes:*$\frac{\partial R_A}{\partial r_k} > 0$, $\frac{\partial R_A}{\partial r_s} > 0$ $\frac{\partial R_A}{\partial r_{na}} < 0$, $\frac{\partial R_{NA}}{\partial r_{na}} > 0$, $\frac{\partial R_{NA}}{\partial r_k} < 0$, $\frac{\partial R_{NA}}{\partial r_s} < 0$, $\frac{\partial^2 R_A}{\partial r_k \partial r_{NA}} < 0$ *and* $\frac{\partial^2 R_A}{\partial r_s \partial r_{NA}} < 0$.

Here, r_k denotes restructuring by an acquiring incumbent, r_{NA} denotes restructuring by a non-acquiring incumbent and r_s denotes restructuring by a private equity backed firm. To see that our results hold, suppose first that an incumbent acquired the target in stage one and that the managers decision on $r^*(g)$ is unaffected. An acquiring incumbent and non-acquiring incumbents invest in governance such that for the incumbent $g_k^* = \arg\max_{g_k}[R_A(g_k, g_{NAk}) - C(g_k) - F]$, and for each non-acquiring incumbent

$g_{NAk}^* = \arg\max_{g_{NA}}[R_A(g_k, g_{NAk}) - C(g_{NAk}) - F]$. The Nash-equilibrium in governance ($\{g_k^*, g_{NAk}^*\}$) is obtained from

$$\frac{dR_A(g_k^*, g_{NAk}^*)}{dr_k}\frac{dr_k^*}{dg_k} = C'(g_k^*), \text{ and} \tag{43}$$

$$\frac{dR_{NA}(g_k^*, g_{NAk}^*)}{dr_{NA}}\frac{dr_{na}^*}{dg_{NAk}} = C'(g_{nak}^*). \tag{44}$$

If a private equity firm obtained the target in stage one, the private equity firm and non-acquiring incumbents invest to improve governance such that for the private equity backed firm $g_s^* = \arg\max_{g_s}[S^3 - C(g_s) - (F - \Delta)]$ with $S^3 = R_A(g_s, g_{NAs}) - R_{NA}(g_s, g_{NAs})$, and for each non-acquiring incumbent $g_{NAs}^* = \arg\max_{g_{NAs}}[R_A(g_s, g_{NAs}) - C(g_{NAs}) - F]$. The Nash equilibrium ($\{g_s^*, g_{NAs}^*\}$) is obtained from

$$\left[\frac{dR_A(g_s^*, g_{NAs}^*)}{dr_s} - \frac{dR_{NA}(g_s^*, g_{NAs}^*)}{dr_s}\right]\frac{dr_s^*}{dg_s} = C'(g_s^*), \text{ and}$$

$$\frac{dR_{NA}(g_s^*, g_{NAs}^*)}{dr_{NA}}\frac{dr_{NA}^*}{dg_{NAs}} = C'(g_{NAs}^*)$$

Comparing the first order conditions that determine the Nash equilibrium, we can see that a private equity backed firm implements stronger governance and induces more restructuring than an incumbent ($r_s^*(g_s^*) > r_k^*(g_k^*)$) and that non-acquirers invest less in governance and restructuring when the target is private equity backed compared to when the target is acquired by an incumbent ($r_{NA}^*(g_{NAs}^*) < r_{NA}^*(g_{NAk}^*)$). These results follow from the Assumption 3. Since investments in inducing restructuring are strategic substitutes, the non-acquiring incumbents prefer to reduce their investments if the target is private equity backed since private equity firms have stronger incentives to induce restructuring in the target than incumbents.

That restructuring activities are strategic substitutes ensures us that $r_s^*(g_s^*) > r_k^*(g_k^*)$. But what if they are strategic complements? Then, we could still have that $r_s^*(g_s^*) > r_k^*(g_k^*)$, even though $r_{NA}^*(g_{NAs}^*) > r_{NA}^*(g_{NAk}^*)$. However, it could now equally well be that incumbents become so aggressive in restructuring that $r_s^*(g_s^*) > r_k^*(g_k^*)$ no longer holds and then overinvestment will not occur.

A.7   Other Selling Mechanisms

In the analysis, we have assumed that the seller of the target uses a first-price sealed bid auction. We believe this auction set-up accurately approximates bidding competition in oligopolies. But some possibilities for creating additional rents are neglected as a result. More generally, Jehiel et al. (1999) show that sophisticated mechanisms are needed to maximize revenues in auctions with externalities; it could be that all firms in the market need to provide transfers to the seller. As pointed out by Jehiel and Moldovanu (2000), the seller needs an unrealistically strong commitment power, making such mechanisms impractical. One potential feasible way for the target to extract more rents is to threaten to commit to

sell to a private equity firm. An incumbent would be willing to pay v_{ks} in the initial acquisition auction, which would give the target larger proceeds compared to when it sells to a private equity firm (since $S^1 = v_s < v_{ks}$).

One way of achieving this would be to state a reservation price of v_{ks}, but this will not work unless the target can restructure its own assets. The reason is that if the reservation price is $v_{ks} > v_s$, private equity firms will not participate in the auction and the threat of selling to one of them will not be credible. The maximum willingness to pay for incumbents would then be v_{kk} and the target would be forced to charge a reservation price lower than v_{ks}.

B   Proofs

B.1   Proof of Lemma 1

Consider the equilibrium candidate $\mathbf{b}^* = (b_1^*, b_2^*, ..., b_n^*)$. 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 $b_f^* = \omega_{kk} - \varepsilon = S^3(r)$.

B.2   Proof of Lemma 4

For the remainder of this proof, $l \in \{s, IPO\}$ as determined by equation (30). Submitting a bid $b_i \geq \max\{v_{kl}, v_{kk}, v_l\}$ is a weakly dominated strategy. No owner wants to post a bid above its valuation of obtaining the target and the target will always be sold.

Inequality $I1'$ ($v_{kk} > v_{kl} > v_l$): Since $v_{kl} > v_l$, an incumbent will always have incentives to prevent a private equity firm from acquiring the target. The incumbents will then bid up the price to ω_{kk} to prevent a rival incumbent from obtaining the target and one of them will win the auction.

Inequality $I2'$ ($v_{kk} > v_l > v_{kl}$): Since $v_l > v_{kl}$, the outcome depends on what an incumbent believes will happen if it does not win. If it believes that another incumbent will bid and win, incumbents will bid up the price to ω_{kk} and an incumbent will obtain the target. If it believes that a buyout will take place, then since $v_l > v_{kl}$ the private equity firms will bid up the price to v_s and one if them will win the auction.

Inequality $I3'$ ($v_{kl} > v_{kk} > v_l$): Since $v_{kl} > v_l$, an incumbent will always have an incentive to prevent a private equity firm from acquiring the target. The incumbents will then bid up the price to ω_{kk} and one of them will win. Since incumbents realize that buyout will never take place ($v_{kl} > v_l$), the price will not be bid up to v_{kl}.

Inequality $I4'$ ($v_{kl} > v_l > v_{kk}$): Since $v_{kl} > v_l$, an incumbent will always have an incentive to prevent a private equity firm from winning and bid up the price to slightly above v_l. However, only one incumbent owner has this incentive, since no other incumbents want to bid higher ($v_l > v_{kk}$). An incumbent will then obtain the target at price v_l.

Inequality $I5'$ ($v_l > v_{kk} > v_{kl}$): Since $v_l > v_{kl}$, no incumbent would like to prevent a private equity firm from acquiring the target. The private equity firms will then bid up the price to v_l and one of them will obtain the target.

Inequality $I6'$ ($v_l > v_{kl} > v_{kk}$): Since $v_l > v_{kl}$, no incumbent would like to prevent a private equity firm from acquiring the target. The private equity firms will then bid up the price to v_l and one of them will obtain the target.

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