

Small Scale Entry vs. Acquisitions of Small Firms:

Is concentration self-reinforcing?

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Abstract: We consider a reduced form model with acquisitions and entry. There are two investors and several small non-investing firms. One investor can acquire a small firm; the other investor decides about market entry. After that *all* firms play an oligopoly game. We derive conditions under which market concentration arises with myopic firms. We apply the framework to a Cournot model with cost synergies and a Bertrand model where acquisitions extend the product spectrum of a firm.

Keywords: Acquisitions, Entry, Concentration, Synergies, Product Variety.

JEL: D43, L11, L12, L13

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1 Introduction

Mega-mergers are one of the favorite topics of the business press. Acquisitions of small firms by dominant competitors generate much less attention. Nevertheless, they are equally important in many industries. Such acquisitions can lead to strong increases in concentration unless countervailing forces arise, such as entry by small firms.

This paper therefore considers a setting in which large firms can acquire small firms and small firms can enter. We analyze under which circumstances acquisitions as a force towards concentration dominate over entry as a countervailing force.¹ For instance, Sutton (1991) discussed such behavior in the British beer industry where concentration increased throughout most of the last century. Large brewers acquired small ones to gain access to their retail outlets, specifically, pubs. At the same time, there was very little entry. Similar tendencies have been reported for other industries.

To understand the forces behind such outcomes, we consider a two-stage game. An investment stage is followed by (reduced form) product market competition. All but two firms play a passive role in the investment stage; by assumption, they cannot invest. These firms are called *small incumbents*. Of the remaining two firms, one is a *potential entrant* whose investment is market entry. A firm that enters will not differ from a small incumbent thereafter. The other remaining firm is called a *large incumbent*. It is best to think of the large firm as being the result of sequential acquisitions of small (unit size) firms in the past – its size then describes how many constituent small firms it consists of. By assumption, only the large firm is allowed to acquire others. Acquiring competitors has two potential benefits in the *product market stage*. First, the reduction in the number of competitors increases equilibrium profits.² Second, the greater size of the acquiring firm is beneficial in itself:³ This might reflect cost-reducing synergies or additional profits

¹We fully acknowledge that by restricting ourselves to acquisitions and entry we ignore internal investment and exit as important forces of structural change.

²See Perry and Porter (1985)

³These two assumptions do not necessarily imply that the profits after the acquisition are higher than the joint profits of acquiror and acquiree. Salant et al. (1983) show that joint profits usually fall in the linear Cournot model, whereas Barros (1998) points out

from the sale of product varieties that the competitor used to sell. However, acquisitions also have costs. These acquisition costs are closely related to small firm profits; they are most reasonably interpreted as a compensation to the owners of the acquired firm for not earning product market profits.

We identify the circumstances under which a *strong concentration equilibrium* arises, where acquisitions take place, but there is no entry. Such equilibria become more likely (i) the lower the small firm profits, (ii) the greater the profit increase from a size increase for the large firm and (iii) the greater the beneficial effect from eliminating competitors..

We then proceed to derive conditions under which concentration is self-reinforcing, meaning that an acquisition makes future acquisitions more attractive. The most important force towards self-reinforcing concentration is the existence of *demand-markup complementarities*. In many cases, acquisitions have a positive effect on the equilibrium demand and on the mark-up of the acquiror. These effects tend to be self-reinforcing because a high mark-up is more valuable when demand is high. Thus firms who have increased their demand (and mark-up) by eliminating one competitor have greater incentives to increase the mark-up (and demand) by acquiring another competitor. Another potential force towards self-reinforcing concentration could come from *negative acquisition externalities*. If the acquisition has a negative effect on the profits of small outside firms, for instance, because of strong synergies, this will foster self-reinforcing concentration for two reasons. First, as small firm profits fall, entry obviously becomes less attractive. Second, acquisition costs should fall, making acquisitions more attractive.

However, there are several reasonable cases where acquisition externalities are positive rather than negative as small firms that are not acquired benefit from decreasing competition. These benefits often outweigh the losses from facing a "stronger" large firm. Thus, *positive acquisition externalities* are a likely reason why concentration is not always self-reinforcing.⁴ Another limitation to self-reinforcing concentration might come from *decreasing synergies* as the positive effect of an acquisition on the acquiring firm itself (for

they increase if firms are very heterogeneous.

⁴Salant et. al. (1983) and Farrell and Shapiro (1990) show that such positive externalities typically arise in merger models without synergies.

instance, due to cost reduction) may be falling in the number of acquisitions already made.

We apply our model to two familiar examples: a linear Cournot model where acquisitions involve synergies from cost reductions and a model of differentiated price competition (similar to Davidson and Deneckere 1985) where an acquisition expands the product spectrum of the large firm. These models reveal interesting differences. In the synergy model, initial conditions (number of small firms, size of large firm) strongly influence the long-term behavior of the system so that monopolization only arises if the initial number of firms is already sufficiently small and/or the large firm is sufficiently large. In the variety model, concentration increases for arbitrary initial values.

We do not make any claim that increasing concentration is the most likely outcome. The conditions for a strong concentration equilibrium are fairly strong, and they are not likely to be met in general. However, our analysis is helpful to provide a clear intuition as to the circumstances under which increasing concentration is likely or not, which is the main goal of the paper.

Existing literature has considered endogenous changes in market dominance for *given* firm numbers, describing circumstances under which firms that are ahead of others in terms of some state variable can increase their lead over time.⁵ This literature suffers from the obvious drawback that it does not deal with mergers or entry. Nevertheless, the conditions for increasing dominance in such models resemble our conditions for increasing concentration. Ericson and Pakes (1995) and Gowrisankaran (1999) consider market dynamics with endogenous firm numbers. These papers have a more general set-up than ours, but they do not deal with our central question.⁶ Pesendorfer (forthcoming) also focuses on mergers and entry. However, his objective is to demonstrate that in situations where mergers reduce short-term profits of the participants, strategic long-term considerations can make

⁵Variants of these approaches include incremental investment games (Flaherty 1980), learning-by-doing models (Cabral and Riordan 1994) or switching cost models (Beggs and Klemperer 1992); Athey and Schmutzler (2001) provide an integrated approach.

⁶Gowrisankaran and Holmes (2004) analyze long-term dynamics in an asymmetric setting with large firms and small firms, but they do not consider entry.

them profitable. Issues of firm heterogeneity and entry incentives that are central to our paper are not addressed.

The paper is organized as follows. Section 2 introduces our model. In section 3, we characterize static equilibria. Section 4 contains a discussion of self-reinforcing concentration. Section 5 discusses examples. In Section 6, we provide an overview of the forces towards and against increasing concentration identified in our paper, and we discuss possible extensions.

2 The Model

We consider a two stage game, with an investment stage followed by product market competition. The players are a *large incumbent*, *small incumbents* and a *potential entrant*. The total number of firms is I . Each firm i 's size at the beginning of the game is summarized by a state variable $Y_i^0 \in \mathbb{N}$. For incumbents, $Y_i^0 > 0$. If $Y_i^0 = 1$, an incumbent is called small, otherwise large. For the entrant, $Y_i^0 = 0$. $\mathbf{Y}^0 = (Y_1^0, \dots, Y_I^0)$ is the initial state vector.

In the first stage, the large firm (firm 1) can invest (i.e., acquire a small firm). By assumption, an acquisition increases the state of the acquiring firm by 1 and reduces the state of the acquiree to 0. Also, by assumption the small incumbent cannot invest. For the entrant (firm 2), investment means entering the market. For simplicity, we assume that an entrant can only enter as a small firm. Thus, given the initial states Y_i^0 , firms simultaneously choose investment levels $a_i \in \{0, 1\}$, and the new state of the investing firms is $Y_i^1 = Y_i^0 + a_i$.

Product market competition is summarized in the following assumptions:⁷

- (A1) For every vector $\mathbf{Y}^1 = (Y_1^1, \dots, Y_I^1)$, there exists a unique profile of equilibrium payoffs $\Pi^i(\mathbf{Y}^1)$ for $i = 1, \dots, I$.
- (A2) Profits are exchangeable: that is, first, for any firm i a permutation of the vector \mathbf{Y}_{-i}^1 does not change the profits of firm i ,⁸ and second,

⁷Of the following assumptions, we will only need (A1), (A2) and (A4) to derive our results. We appeal to (A3) and (A5) only for interpretations.

⁸As usual, \mathbf{Y}_{-i} stands for the vector of states of all firms except firm i .

if $i \neq j$ such that $Y_i^1 = Y_j^1$ and \mathbf{Y}_{-i}^1 is identical with \mathbf{Y}_{-j}^1 up to a permutation, then $\Pi^i(\mathbf{Y}^1) = \Pi^j(\mathbf{Y}^1)$.

(A3) $\frac{\partial \Pi^i}{\partial Y_j^1} < 0$ for $j \neq i$:⁹ that is, other things being equal, profits are lower the higher the state of the competitor.

(A4) $\Pi^i(\mathbf{Y}^1) = 0$ if $Y_i^1 = 0$.

By (A2), the product market profit of each firm is fully determined by the state of the large firm and the total number $F^1 = F^0 + a_2 - a_1$ of small firms in the industry. Thus, we denote small firms' profits as $\Pi^S(Y_1^1, F^1)$ and the large firms' profits as $\Pi^L(Y_1^1, F^1)$, respectively.¹⁰ Entry costs are exogenous, given as $E > 0$. Acquisition costs, however, depend on the outside options of small firms. Their owners will only agree to a takeover if the profits they could earn with a small firm are not higher than what they get as a compensation for the takeover. By (A3), small firm profits are decreasing in the size of the large firm and the number of small competitors.¹¹ This assumption is reasonable in many contexts, but in the example section, we shall also discuss its limitations. As long as (A3) holds, the following assumption is natural:

(A5) Acquisition costs are a function $AC(Y_1^1, F^1)$ that is decreasing in both variables.

3 Equilibrium Conditions

The payoffs of the one-period game are presented in Table 1.

< Table 1 about here >

⁹In the following, we argue as if the profit functions were also defined for non-integers so that derivatives make sense. At the cost of a more complicated notation, we could dispense with this assumption.

¹⁰For instance, suppose, $Y_1^1 = M \geq 2, Y_2^1 = Y_3^1 = Y_4^1 = 1$. Then profits for firm 1 are $\Pi^L(M, 3) = \Pi^1(M, 1, 1, 1)$ and $\Pi^S(M, 3) = \Pi^i(M, 1, 1, 1)$ for firms $i = 2, 3, 4$.

¹¹Note, however, that $\partial \Pi^S / \partial Y_1^1 < 0$ from assumption (A3) does not exclude the possibility of positive acquisition externalities on small firms' profits. Positive externalities might still arise even though there is a negative impact of a larger competitor on the small firm profit because an acquisition simultaneously reduces the number of firms competing in the market, increasing profits of the remaining firms.

It is straightforward to show that all conceivable constellations of pure strategy equilibria arise for suitable parameters.¹² We give explicit conditions for the *strong concentration equilibrium* $(a_1, a_2) = (1, 0)$.

To this end, we introduce the following notation. Let

$$NEG(Y_1, F) \equiv \Pi^S(Y_1, F) - E$$

denote *the net entry gain*, the increase in payoff resulting from entry into a market with a large firm with state Y_1 and F other small firms. Let

$$NAG(Y_1, F) \equiv \Pi^L(Y_1 + 1, F - 1) - \Pi^L(Y_1, F) - AC(Y_1 + 1, F - 1)$$

be the *net acquisition gain*, the payoff increase from an acquisition for a firm of size Y_1 when there are F small firms in the market without the acquisition.

Proposition 1 *The strong concentration equilibrium $(1, 0)$ arises as a unique pure strategy equilibrium if the following conditions hold simultaneously:*

- (i) $NEG(Y_1^0 + 1, F^0) < 0$ (ENT1)
- (ii) $NAG(Y_1^0, F^0) > 0$ (ACQ0)
- (iii) $NEG(Y_1^0, F^0 + 1) < 0$ or (ENT0)
 $NAG(Y_1^0, F^0 + 1) > 0$ (ACQ1)

The proof involves straightforward checks of best response conditions.¹³ For instance, (ENT1) is the no-entry condition and (ACQ0) is the acquisition condition.¹⁴ Together they guarantee existence. (iii) gives uniqueness.

To interpret the proposition, introduce the following notation

$$\begin{aligned} OSE &= \Pi^L(Y_1 + 1, F - 1) - \Pi^L(Y_1, F - 1) \\ MSE &= \Pi^L(Y_1, F - 1) - \Pi^L(Y_1, F). \end{aligned}$$

¹²Specifically, we can have each of the four conceivable unique equilibria, multiple equilibria $[(0, 0) / (1, 1)$ or $(0, 1) / (1, 0)]$ or no pure strategy equilibria.

¹³For existence, it suffices that conditions (ENT1) and (ACQ0) hold with weak inequality.

¹⁴The numerical symbol in the conditions denotes the opponent player's action. For instance, (ENT1) says that entry is not profitable for the entrant, given that the large firm plays $a_1 = 1$.

OSE is the *own state effect*, describing how the higher own state after an acquisition translates into (usually) higher profits. MSE is the *market structure effect*, which isolates the profit increase resulting from the elimination of one competitor. Then, we have

$$NAG(Y_1, F) = OSE + MSE - AC(Y_1 + 1, F - 1).$$

Thus, if profit reacts strongly to an increase in the own state, $(ACQ0)$ and $(ACQ1)$ are more easily fulfilled as OSE tends to be large. Further, if the adverse effect of an additional competitor on one's own profit is higher, the acquisition condition is also more easily fulfilled as MSE is larger. Finally, if small firms earn lower profits, conditions $(ENT0)$ and $(ENT1)$ are more easily met. Also, as small firm profits are roughly equivalent to acquisition costs, $(ACQ0)$ and $(ACQ1)$ are easier to fulfill if small firm profits are low.

Thus, we obtain the following corollary.

Corollary 1 *If the parameters of the model change so that small firm profits fall or OSE rises or MSE falls, the strong concentration equilibrium becomes more likely (other things being equal).*

It is tempting to speak of an increase in competition if the three conditions in corollary 1 hold simultaneously for a parameter change: In a competitive environment, one would clearly expect small firm profits to be low. Also, there should be a particularly large payoff to getting ahead of others (high OSE) and to eliminating competitors (MSE).

Even though such a notion of competitiveness has some appeal, it is not fully consistent with alternative measures of competition that are used in specific examples.¹⁵ For instance, consider a model with Cournot competition and linear demand $x = a - p$. Suppose marginal costs $c(Y_i)$ are decreasing in Y_i , so that there are cost synergies from acquisitions. Then firms are in a standard heterogeneous Cournot model. In such a model, a reduction in a is typically regarded as increasing competition. Indeed, it reduces profits of small (inefficient) firms. However, it also reduces large firm profits, which

¹⁵Boone (2000) provides a more comprehensive discussion of measures of competition.

are

$$\pi_L = \frac{[a - Ic(Y_1) + (I - 1)c(1)]^2}{(I + 1)^2}.$$

As a result,

$$\frac{\partial^2 \pi_L}{\partial a \partial Y_1} = -2I \left(\frac{1}{2I + I^2 + 1} \right) > 0.$$

Thus, negative effects of increasing competition (decreasing a) on profits translate into decreasing benefits from "getting ahead" $\left(\left| \frac{\partial \pi_L}{\partial Y_1} \right| \right)$. In other words, the *OSE* falls as a decreases.

Similar considerations hold in differentiated oligopoly with the elasticity of substitution as a standard measure of competition.

As we shall see in the examples, however, even when the requirements of "more intense competition" are not fulfilled simultaneously for some change of parameters that is loosely associated with more intense competition, it is often true that the strong concentration equilibrium becomes unambiguously more likely as a result of the parameter shift.

4 Comparative Statics

We now carry out a simple comparative statics exercise. We compare the equilibrium for initial values (Y_1^0, F^0) and $(Y_1^0 + 1, F^0 - 1)$, respectively. The motivation for this exercise is obvious. Compared to (Y_1^0, F^0) , the constellation $(Y_1^0 + 1, F^0 - 1)$ corresponds to a situation after an acquisition, that is, after concentration has increased. We ask under which conditions an acquisition makes a further acquisition more likely, that is, under which conditions concentration is self-reinforcing. The following terminology is useful.¹⁶

Definition 1

- (1) There are **positive (negative) acquisition externalities** at (Y_1^0, F^0) if $\Pi^S(Y_1^0 + 1, F^0 - 1) > (<) \Pi^S(Y_1^0, F^0)$.
- (2) There are **increasing (decreasing) acquisition costs** at (Y_1^0, F^0) if $AC(Y_1^0 + 1, F^0 - 1) > (<) AC(Y_1^0, F^0)$.

¹⁶As usual subscripts stand for partial derivatives.

(3) *Product market competition satisfies strong demand-markup complementarities (SDMC) if $\Pi_{Y_1 Y_1}^L \geq 0, \Pi_{Y_1 F}^L \leq 0$ and $\Pi_{FF}^L \geq 0$.*

Acquisition externalities are thus positive if the benefits for a small firm from the elimination of one small competitor outweigh the losses from facing a larger competitor.¹⁷ As acquisition costs depend on small firm profits, positive acquisition externalities and increasing acquisition costs are closely related; generally, one would expect increasing acquisition costs whenever acquisition externalities are positive.¹⁸

To understand strong demand-markup complementarities (3), represent product market profits $\Pi^L(Y_1, F)$ as the product of equilibrium demand for the large firm, $D^L(Y_1, F)$, and the price-unit cost difference (mark-up), $M^L(Y_1, F)$, so that

$$\Pi^L(Y_1, F) = D^L(Y_1, F) \cdot M^L(Y_1, F).$$

Clearly, $\Pi_{FF}^L = 2D_F^L \cdot M_F^L + D_{FF}^L \cdot M^L + D^L \cdot M_{FF}^L$. Under the natural assumption that the presence of additional competitors reduces both equilibrium demand and mark-up (i.e., $D_F^L < 0$ and $M_F^L < 0$), the first term on the right-hand side is positive, reflecting a complementarity between demand and mark-up (a higher mark-up is more valuable for higher demand). The remaining terms might be negative, but in many cases the complementarity dominates, so that $\Pi_{FF}^L \geq 0$. In the following, we shall speak of *demand-markup complementarity (DMC)* between two variables if changes in these variables (e.g. reductions in firm numbers) both increase demand and mark-up and therefore reinforce each other in their effects. For *strong* mark-up demand complementarity, *DMC* dominates over countereffects arising from second derivatives of D^L and M^L . Demand-markup complementarities also

¹⁷The two competing effects both result from (A3).

¹⁸Also, there is a close relation between positive acquisition externalities and the requirement $\Pi_{FF}^L \geq 0$ in the definition of strong demand-markup complementarities. Positive acquisition externalities essentially say that the elimination of a small competitor is more valuable than the reduction in size of a large competitor. This is a special case of the requirement that the smaller a competitor is, the more valuable it is to make it even smaller. Similarly, $\Pi_{FF}^L \geq 0$ says that the smaller the number of small competitors, the more valuable it is to make this number even smaller.

justify the assumption $\Pi_{Y_1 F}^L \leq 0$; since an increase in own size Y_1 and a reduction in the number of competitors F both have a positive effect on demand and mark-up, these effects are self-reinforcing, which explains why $\Pi_{Y_1 F}^L \leq 0$ might arise.¹⁹ $\Pi_{Y_1 Y_1}^L \geq 0$ could be justified by similar demand-markup complementarities. However, in Section 4, we provide plausible examples where $\Pi_{Y_1 Y_1}^L \geq 0$ does not hold because the demand-markup complementarity is overwhelmed by concavity of D^L and M^L with respect to Y_1 .²⁰

We now give a sufficient condition for self-reinforcing concentration.

Proposition 2 *Suppose there are negative acquisition externalities, decreasing acquisition costs and strong demand-markup complementarities. Then concentration is self-reinforcing; that is, the set of parameters for which a strong concentration equilibrium arises is greater for $(Y_1^0 + 1, F^0 - 1)$ than for (Y_1^0, F^0) .*

Proof. Appendix 1²¹ ■

These conditions for self-reinforcing concentration are hard to satisfy simultaneously. Even so, the proposition is useful in identifying the forces towards and against endogenous monopolization since demand-markup complementarities are often a natural force towards self-reinforcing concentration. Negative acquisition externalities and decreasing acquisition costs also work in the same direction. However, arguably, they are less likely to hold; at least if the competition effect from eliminating a small firm is strong relative to the "synergy effect" that the large firm is a more powerful competitor, acquisition externalities are likely to be positive.²² This suggests a natural force against monopolization; as the number of remaining firms in the market becomes small, acquisition externalities will often become positive as the elimination of any one competitor has a strong positive effect on the profits of the remaining firms. Thus, increasing acquisition costs stop the

¹⁹ $\Pi_{Y_1 F}^L = D_{Y_1}^L \cdot M_F^L + D_F^L \cdot M_{Y_1}^L + D_{Y_1 F}^L \cdot M^L + D^L \cdot M_{Y_1 F}^L$. (DMC) implies that the first two terms on the r.h.s. are non-positive. Therefore, as long as $|D_{Y_1 F}^L|$ and $|M_{Y_1 F}^L|$ are sufficiently small, $\Pi_{Y_1 F}^L \leq 0$.

²⁰ $\Pi_{Y_1 Y_1}^L = 2D_{Y_1}^L \cdot M_{Y_1}^L + D^L \cdot M_{Y_1 Y_1}^L + D_{Y_1 Y_1}^L \cdot M^L$. Thus (DMC) implies that the first term on the r.h.s. is non-negative, but not necessarily the remaining terms.

²¹Appendices are available on the JEBO website.

²²See Farrell and Shapiro (1990) and Salant et al. (1983).

tendency towards monopolization. As we shall see in specific examples, this *may* indeed happen. However, we shall also provide an example where there is a strong tendency towards monopolization in spite of positive acquisition externalities.

5 Examples

We now study the interplay of forces towards increasing concentration and countervailing forces in two examples. First, we consider cost-reducing acquisitions in a linear Cournot example. Second, we analyze "mergers for variety" where the acquisition increases the product spectrum of a firm. In the former case, the resulting equilibrium and the myopic dynamics will turn out to depend substantially on the initial situation. In the latter case, however, the tendency towards increasing concentration will be very strong.

In line with the general notion that acquisition costs reflect opportunity costs of the takeover targets, we assume that acquisition costs amount to

$$AC(Y_1^0 + 1, F^0 - 1) = \min \{ \Pi^S(Y_1^0, F^0), \Pi^S(Y_1^0 + 1, F^0 - 1) \}. \quad (1)$$

In Appendix 2, we provide a detailed game-theoretical justification for this specification.²³

5.1 The Synergy Game

Our first example mainly serves to show that the initial industry constellation influences whether concentration is self-reinforcing. If the initial firm number is small, a concentration equilibrium exists, reflecting demand-markup complementarities. If the initial firm number is large enough, increasing acquisition costs and declining synergies can eventually destroy the concentration equilibrium.

To see this, we specify the set-up of section 2 as follows. Firms compete in a homogenous-good industry. Inverse demand is given by $p = \alpha - \beta X$, where p is the price, X is the total quantity sold in the industry and α and β

²³Appendices are available on the JEBO website.

are demand parameters. Firm i has the cost function $C_i = x_i/Y_i^\gamma$, where x_i is the quantity produced by firm i and $\gamma > 0$ is a synergy parameter. Thus, the large incumbent has lower marginal costs than the small incumbents, whose marginal costs are normalized to 1. These synergies are, however, decreasing in the number of firms already acquired.

For $\alpha = 5, \beta = \gamma = 1$ and $E = 0.75$, Figure 1 describes the combinations of Y_1^0 and F^0 for which each type of equilibrium emerges in the static game.²⁴ The lines in the figure correspond to the boundaries of the (no-)entry conditions $ENT1$ and the acquisition conditions $ACQ0$ from Proposition 1.

< Figure 1 about here >

In this example, three pure strategy equilibria arise: the strong concentration equilibrium $(1, 0)$, the *weak concentration equilibrium* $(1, 1)$ where both players invest, and the *stationary equilibrium* $(0, 0)$ where no player invests.²⁵ To understand how the equilibrium depends on initial values, consider the effects of these values on the profitability of entry and acquisitions, respectively. First, note that entry becomes harder when there are many firms in the market and/or when the large incumbent has a high state, that is, low marginal costs, which explains the declining line ENT_1 . This is a reflection of (A3), which is very natural in the context of this example: A high-state firm has lower costs, which induces more aggressive behavior and therefore a higher output. Such a higher output involves a negative externality for the other firms in the market.

More interestingly, the acquisition condition is non-monotone in the initial number of small firms F^0 . To understand this, recall that an acquisition of a small incumbent is more profitable the higher OSE and MSE and the lower AC . In general, changes in the number of small firms do not satisfy these three conditions simultaneously. Concerning OSE , the effect of any given cost reduction on profits usually is higher the lower the number of other firms in the market;²⁶ with a lower number of competitors, the own

²⁴The result uses proposition 1 for the equilibrium $(1, 0)$ and similar conditions for the other equilibria.

²⁵For other parameterizations, additional constellations might arise, including multiple equilibria.

²⁶The size of the reduction itself is independent of the firm number.

output level will be higher, making cost-reductions more valuable. This reflects demand-markup complementarities. Thus, OSE should become larger as the number of competitors is smaller. The same is true for MSE ; intuitively, positive mark-up effects from eliminating competition are higher when the firm already has a high market share. On the other hand, acquisition costs increase as the number of small firms fall (because of higher small firm profits). To sum up, OSE , MSE and AC should all increase as the number of firms falls. The non-monotonicity in our example may thus be explained as follows. Starting from high firm numbers, when these numbers are reduced, increasing acquisition costs first dominate over the increase in OSE and MSE , and acquisitions become less attractive. As F^0 decreases further, the effect of increasing OSE and MSE eventually dominates so that acquisitions become more likely.

In Figure 1, an increase in Y_1^0 unambiguously makes the acquisition condition harder to satisfy. This reflects decreasing synergies, which reduce OSE . However, there are also countervailing effects of increasing Y_1^0 . First, any given cost reduction is more valuable the higher the market share (again reflecting demand-markup complementarities). Second, decreasing acquisition costs also have to be taken into account. Therefore, for alternative specifications (for instance, non-decreasing synergies), the impact of Y_1^0 on acquisition incentives may be reversed.

Though our analysis is static, Figure 1 suggests a potentially important implication for market dynamics. If the static game is played repeatedly, the long-term behavior depends on the initial value of the large firm's size and the initial number of firms in the market. When there are few small firms initially (as in point A), monopolization will eventually arise since the system moves one unit down and one unit to the right whenever there is a strong concentration equilibrium. Thus, even though synergies are declining and acquisition costs are rising, firm asymmetries become increasingly pronounced. When there are many small firms initially, however (as in point B), the concentration process may come to a halt long before monopolization, as the system reaches the stationary equilibrium. This result has interesting implications. It would for instance suggest that a newly privatized industry with a large incumbent and a small fringe may never develop towards a com-

petitive market, whereas an otherwise identical industry may have a chance to retain a relatively competitive market structure when it starts out with less asymmetry.²⁷

The effects of changes in other parameters are briefly summarized without figures. Consider the market size parameter α and the synergy parameter γ . Entry becomes less likely as α decreases and γ increases. Acquisition conditions are also easier to fulfill as γ increases. Less obviously, a decrease in α makes acquisitions more likely. This mainly reflects the effects of decreasing acquisition costs.

5.2 Merging for Variety

We now provide an example where the tendency towards monopolization is much stronger. In spite of increasing acquisition costs, demand-markup externalities are so overwhelming that all equilibria involve acquisitions. To this end, we consider the case that firms use mergers and acquisitions to expand into related markets.²⁸ Accordingly, we now interpret a firm's state variable as the number of product varieties it sells. $\Pi^L(Y_1^1, F^1)$ is the profit of a large firm that sells Y_1^1 varieties when there are F^1 small firms in the market, each selling one variety. $\Pi^S(Y_1^1, F^1)$ is the profit of a small firm facing a large firm that sells Y_1^1 varieties and $F^1 - 1$ other small firms. We introduce the additional notation $\pi^L(Y_1^1, V^1) = \Pi^L(Y_1^1, V^1 - Y_1^1) / Y_1^1$ for the profit of a large firm per variety sold when its state is Y_1^1 and the total number of varieties is $V^1 = Y_1^1 + F^1$. We thus write $\pi^S(Y_1^1, V^1) = \Pi^S(Y_1^1, V^1 - Y_1^1)$ for the profits of a small firm when the total number of varieties is V^1 and the large competitor sells Y_1^1 varieties.²⁹

Suppose inverse demand is $p_l = a - bx_l - c \sum_{k \neq l} x_k$ with $a, b, c > 0$ and

²⁷However, the result of increasing dominance when starting at point A may be an artifact of the simplifying assumption that only one firm is able to carry out acquisition. Otherwise, countervailing effects may arise. The reason is that, with declining synergies, smaller firms should also have higher acquisition incentives than large firms, leading to a tendency towards declining asymmetries between firms.

²⁸The model is related to Davidson and Deneckere. However, these authors consider only incentives to merge and not incentives to enter.

²⁹Implicit in this set-up is the symmetry assumption that each small firm earns the same profit and that the large firm earns the same profit for each variety.

$b > c$. Firms compete in prices.³⁰ We set $a = 5, b = 1, c = 0.75$ and $E = 0.15$. Figure 2 summarizes the equilibria. Note that the figure is only meaningful for $Y_1^0 \leq V^0$, the region above the bold line.

< Figure 2 about here >

There are some important differences with respect to the synergy example. First, market entry becomes more likely as the large incumbent sells more varieties. This reflects positive acquisition externalities as large firms price less aggressively to avoid cannibalizing demand on its other varieties.³¹ Second, for a similar reason, as the number of varieties Y^0 sold by the large firm increases, further acquisitions become more attractive in spite of increasing acquisition costs. Intuitively, the more varieties the large firm already sells, the larger the beneficial effect of controlling the prices and thus the mark-up for an additional variable. Again, this is an instance of demand-markup complementarities.

The resulting equilibrium behavior is much simpler than in the synergy example since only the strong and the weak concentration equilibria $((1, 0)$ and $(1, 1))$ are possible.³² The strong concentration equilibrium is more likely when the total number of varieties V^0 is large and the large firm sells a small number of these varieties, because entry becomes less attractive. More interestingly, acquisitions are worthwhile for arbitrary initial conditions. Thus, the positive effects from acquisitions are always greater than the acquisition costs (i.e., small firm profits). Intuitively, the benefits from an acquisition

³⁰For price competition, it would seem more natural to consider demand functions $x_l = A - Bp_l + C \sum_{k \neq l} p_k$ rather than inverse demand. However, this would, for instance, imply that the maximal demand per variety is independent of the number of varieties. Our demand system corresponds to a demand function $x_l = A(V) - B(V) + C(V) \sum_{k=l} p_k$ with $A' < 0, B' > 0, C' < 0$, which seems more plausible.

³¹Even so, (A3) still holds: If a large firm introduces a new variety without acquiring a small firm, the negative effect of the competitors coming from the increasing number of varieties dominates over the positive effect of softer behavior.

³²This result might appear to contradict Sutton's (1998) general result that markets with a certain degree of horizontal product differentiation reveal low concentration levels. However, in his model the firm number is fixed. Further, firms are not involved in acquisition and market entry decisions, respectively, but in the choice of quality levels for each of their varieties.

consist of the profits from selling one more variety and the increased profits on the other varieties that comes from the control over the prices of an additional variety. The second effect introduces a wedge between small firm profits, that is, acquisition costs, and acquisition benefits, which is why acquisitions are so attractive in this context.

We briefly report the effects of two other parameters. An increase in market size a makes entry more likely. Also, it turns out that market size increases leave the acquisition condition unaffected so that the strong concentration equilibrium becomes less likely.³³ An increase in substitutability c decreases entry incentives and increases acquisition incentives so that the strong concentration equilibrium becomes more likely. Both observations are consistent with the intuitive notion that increasing intensity of competition increases the chances for a strong concentration equilibrium.

5.3 An Application: The Beer Industry in the UK

In the mid 1980's, the United Kingdom Monopolies and Mergers Commission (MMC) investigated the beer industry.³⁴ At this time, the industry concentration was substantial: six national brewers had a market share of about 75 %. This state was the outcome of a process that had been going on for about a century. Acquisitions of small firms by large brewers played an important role, whereas entry was negligible. Therefore, the industry evolution corresponds roughly to a sequence of strong concentration equilibria.

Two features of the UK beer market have been crucial for the emergence of the concentrated market structure. First, according to Slade, "on-premise" sales, i.e., sales in public houses or similar outlets account for an unusually high proportion of total sales (around 85%). Second, the extent of vertical integration has been very high throughout the century, and as early as 1913, the proportion of "tied houses" was 95 % ; similarly for 1950 (Sutton 1991).³⁵ As a crude approximation, one can therefore think of the beer industry as consisting of vertically integrated firms who sell beer to customers in pubs.

³³This is a result of the linear specification.

³⁴This section relies heavily on Sutton (1991) and Slade (1998).

³⁵"Tied Houses" are pubs that are owned by a brewery or at least are provided with cheap capital (Slade).

Each pub corresponds to a different product variety. This would suggest that the industry matches our "merger for variety" model. Indeed, according to Sutton (1991, 516), "the main scope for expansion ... lies in acquiring rival brewers and so obtaining access to their retail outlets."

Thus, in our language, firms acquire others to control product varieties. The industry evolution is therefore consistent with our "merger for variety" model that gives rise to strong concentration equilibria when entry costs are sufficiently high. This condition indeed holds; because of severe licensing restrictions, the possibility of entry has been limited.

Note, however, that access to retail outlets is not the only motivation for acquisitions in the beer industry. Sutton (1991) suggests that, in spite of the high level of concentration before the MMC investigation, plant size was still slightly below the minimum efficient scale. Earlier acquisitions may therefore also be interpreted as attempts to achieve cost-reducing synergies. Of course, if these synergies were sufficiently strong, this provides another reason why the *OSE* might have been high enough for a strong concentration equilibrium to emerge.

6 Conclusions and Extensions

Our analysis has dealt with two separate, but closely related issues. Proposition 1 identified forces towards concentration in static situations; Proposition 2 identified under which circumstances concentration is self-reinforcing. We now sum up and interpret our main findings, and we discuss some extensions.

First, consider the circumstances under which a strong concentration equilibrium arises in any one period. These circumstances concern the nature of product market competition, the "technological" assumptions on the acquisition (e.g., extent of synergies, effect on product spectrum of firm) and the initial market structure. Typically, small market size or a low degree of product market differentiation or high synergies result in concentration equilibria.

As we saw in the examples, the number of firms has a more ambiguous effect on the likelihood of concentration equilibria, even though a larger num-

ber of firms would usually be loosely associated with intense competition.³⁶ On the one hand, both acquisition costs and entry profits are negatively related to the total number of firms. On the other hand, the firm number also tends to have a negative effect on *OSE* and *MSE* because demand-markup complementarities are lower as the firm number increases. This is why Proposition 1 does not imply a monotone relation between the firm number and the likelihood of a strong concentration equilibrium in general.

Proposition 2 and the examples in Section 5 give us some idea as to when the simultaneous reduction in firm numbers and the increase in large firm size brought about by an acquisition make further acquisitions more likely, that is, when concentration is self-reinforcing. Demand-markup complementarities are the main force in this direction, if acquisitions have a positive effect on equilibrium demand and mark-up, these effects are often self-reinforcing. Such an effect is present in the synergy model as increasing the mark-up through the synergies from an acquisition is more valuable when the demand is high due to cost reductions from earlier acquisitions. Similarly, in the variety model, increasing the mark-up through obtaining control on a further variety is more valuable when demand is high because the firm already controls a large number of varieties.

Negative acquisition externalities provide another reason why concentration can be self-reinforcing. For instance, such negative externalities will arise in the synergy model for sufficiently large values of the synergy parameter. Negative externalities support self-reinforcing concentration for two reasons. First, decreasing small firm profits make entry less attractive. Second, they imply decreasing acquisition costs, making acquisitions more attractive.

Countervailing forces arise, in particular, from positive acquisition externalities, which are familiar from several oligopoly models. Intuitively, they arise when non-involved firms benefit from mergers because of the reduction in competition. Reversing the argument for negative externalities, posi-

³⁶This relation between the number of firms and the intensity of competition is a *ceteris paribus* statement for exogenous firm numbers, corresponding to the exercise we performed in Section 5.1. When firm numbers are endogenous, a change in external conditions that is generally interpreted as "more intense competition" (e.g., a shift from Cournot to Bertrand) can lead to a reduction in firm numbers (Sutton 1991, ch.2).

tive externalities work against self-reinforcing concentration for two reasons. First, positive acquisition externalities imply that acquisitions increase small firm profits. Therefore, they make future acquisitions more costly, which works against monopolization. Second, the increasing small firm profits associated with positive acquisition externalities make entry more likely, which means that after sufficiently many acquisitions the concentration equilibrium may well break down.

Another countervailing force arises when there are decreasing synergies. Then, in spite of demand-markup complementarities, condition (*SMDC*) need not hold.³⁷

The above statements are clearly of a *ceteris paribus* type, as the "merger for variety" example shows. In spite of increasing acquisition costs, concentration is self-reinforcing because demand-markup complementarities exist.

Various extensions of our approach are conceivable. In the working paper (Aydemir and Schmutzler 2002), we present some additional forces that arise in the context of forward-looking firms. We also show that the main insights survive when there are many large incumbents and potential entrants.³⁸ Finally, it is simple to extend the analysis of Section 3 to the case that the large incumbent has three alternatives: do not invest, acquire a small firm, or carry out an internal investment (at fixed cost K) that increases the size as much as the acquisition. In this case, for the strong concentration equilibrium with acquisitions rather than internal investment to exist, we require the additional condition that

$$\Pi^L(Y_1^0 + 1, F^0 - 1) - \Pi^L(Y_1^0 + 1, F^0) > AC(Y_1^0 + 1, F^0 - 1) - K. \quad (2)$$

An acquisition is more attractive because it has an *MSE* as well as an *OSE*; it might fail to be an equilibrium strategy only if acquisitions are more costly than internal investments. If (2) does not hold, an equilibrium with internal investment and no entry exists when (*ENT1*) holds. The cor-

³⁷Technically, $\Pi_{Y_1 Y_1}^L \leq 0$ may not hold if $D_{Y_1 Y_1}^L \leq 0$ and/or $M_{Y_1 Y_1}^L \leq 0$ and large in absolute terms.

³⁸However, the analysis requires more sophisticated tools (developed in Athey and Schmutzler).

responding no-entry condition always holds. Intuitively, entry is less likely when a large firm invests internally rather than externally because the potential entrant does not benefit from the elimination of a competitor in the former case.

7 Appendix 1: Proof of Proposition 2

Proof. We have to show that

$$\begin{aligned} \Pi^L(Y_1^0 + 1, F^0 - 1) - \Pi^L(Y_1^0, F^0) - AC(Y_1^0, F^0) &\geq \\ \Pi^L(Y_1^0, F^0) - \Pi^L(Y_1^0 - 1, F^0 + 1) - AC(Y_1^0 - 1, F^0 + 1) &\end{aligned} \quad (3)$$

and

$$\Pi^S(Y^0, F^0) \leq \Pi^S(Y^0 + 1, F^0 - 1). \quad (4)$$

By negative acquisition externalities and decreasing acquisition costs, it suffices to show that

$$\Pi^L(Y_1^0 + 1, F^0 - 1) - \Pi^L(Y_1^0, F^0) \geq \Pi^L(Y_1^0, F^0) - \Pi^L(Y_1^0 - 1, F^0 + 1).$$

Using $\Pi_{Y_1 Y_1}^L \geq 0, \Pi_{Y_1 F}^L \leq 0, \Pi_{FF}^L \geq 0$,

$$\begin{aligned}
& \Pi^L(Y_1^0 + 1, F^0 - 1) - \Pi^L(Y_1^0, F^0) = \\
& \Pi^L(Y_1^0 + 1, F^0 - 1) - \Pi^L(Y_1^0, F^0 - 1) \\
& \quad + \Pi^L(Y_1^0, F^0 - 1) - \Pi^L(Y_1^0, F^0) = \\
& \int_{Y_1^0}^{Y_1^0+1} \Pi_{Y_1}^L(Y_1, F^0 - 1) dY_1 - \int_{F^0-1}^{F^0} \Pi_F^L(Y_1^0, F) dF \geq \\
& \int_{Y_1^0}^{Y_1^0+1} \Pi_{Y_1}^L(Y_1^0 - 1, F^0 - 1) dY_1 - \int_{F^0-1}^{F^0} \Pi_F^L(Y_1^0, F) dF = \\
& \int_{Y_1^0-1}^{Y_1^0} \Pi_{Y_1}^L(Y_1, F^0 - 1) dY_1 - \int_{F^0-1}^{F^0} \Pi_F^L(Y_1^0, F) dF \geq \\
& \int_{Y_1^0-1}^{Y_1^0} \Pi_{Y_1}^L(Y_1, F^0) dY_1 - \int_{F^0}^{F^0+1} \Pi_F^L(Y_1^0 - 1, F) dF = \\
& \quad \Pi^L(Y_1^0, F^0) - \Pi^L(Y_1^0 - 1, F^0) \\
& \quad + \Pi^L(Y_1^0 - 1, F^0) - \Pi^L(Y_1^0 - 1, F^0 + 1) = \\
& \quad \Pi^L(Y_1^0, F^0) - \Pi^L(Y_1^0 - 1, F^0 + 1).
\end{aligned}$$

■

8 Appendix 2: Acquisition Prices

We now justify formula (1) for the takeover price, taking the entry decision as given and using the following acquisition game that elaborates the notion that takeover prices depend on the stand-alone profits of small firms. Suppose, in a first stage, the large incumbent states a maximum price at which he is willing to take over the small firm, the reservation price r . In the second stage, all small incumbents i simultaneously name a price s_i at which they are willing to be taken over. If $s^{\min} \equiv \min_i \{s_i\} \leq r$ and $N \geq 1$ firms choose s^{\min} , one of these firms is acquired with probability $1/N$; acquisition costs are then s^{\min} . A firm that is not taken over earns product market payoffs corresponding to the market structure after the acquisition and entry decisions have been made, that is, $\Pi_{NT}^S \equiv \Pi^S(Y_1^0, F^0 + a_E)$ if there is no takeover and $a_E \in \{0, 1\}$

is the entrant's decision, and $\Pi_T^S \equiv \Pi^S(Y_1^0 + 1, F^0 - 1 + a_E)$ if some other firm is taken over. The profits for the large firm are defined analogously as Π_{NT}^L and Π_T^L . We first analyze the Nash equilibria of the second stage game for given values of r . The following Lemma summarizes the small firms' equilibrium strategies and the equilibrium payoffs of all firms.

Lemma 1 (a) *Suppose $\Pi_{NT}^S > r$. Then there is a pure strategy equilibrium without acquisition in which each small firm sets $s_i^* = \Pi_{NT}^S$. The large firm thus obtains net profits of Π_{NT}^L ; each small firm obtains Π_{NT}^S .*

(a1) *If in addition $r < \Pi_T^S$, there is no pure strategy equilibrium where takeover takes place.*

(a2) *If $r \geq \Pi_T^S$, there exists exactly one additional equilibrium, where each firm plays $s_i^{**} = \Pi_T^S$. For the small firms this equilibrium is Pareto-dominated by any equilibrium without acquisition. Also, s_i^{**} is weakly dominated by s_i^* .*

(b) *Suppose $\Pi_{NT}^S < r \leq \Pi_T^S$.*

(b1) *If $r < \Pi_T^S$, then in any pure strategy equilibrium, one firm sets $s_i^* = r$ and is taken over, while all other firms set more than r and earn Π_T^S .*

(b2) *If $r = \Pi_T^S$, all firms set $s_i^* = r$, and one firm is taken over. All small firms earn Π_T^S .*

In any case, the large firm earns net profits of $\Pi_T^L - r$.

(c) *If $r \geq \max\{\Pi_{NT}^S, \Pi_T^S\}$, there is a pure strategy equilibrium where acquisition takes place and each firm sets $s_i^* = \Pi_T^S$. Any other pure strategy equilibrium must have $s^{\min} = \Pi_T^S$.*

Proof. (a) As the small firms demand more for an acquisition than the large firm is willing to pay, there is no takeover if each firm demands Π_{NT}^S . Also, the proposed strategy combination is a Nash equilibrium. To see this, first note that any deviation where $s_i > r$ would not change equilibrium profits, as no takeover would occur. Deviations to $s_i \leq r$ would lead to an

acquisition of the deviating firm. Its profits would fall to $s_i \leq r < \Pi_{NT}^S$.

(a1) First, suppose there is a pure strategy equilibrium where one firm sets $s_i \leq r$ and $s_i < s_j$ for all $j \neq i$. Then firm i is taken over at a price s_i that is smaller than Π_{NT}^S , the profit it would obtain by avoiding takeover with a sufficiently high s_i . Next, suppose there are $N > 1$ firms setting minimal $s^{\min} \leq r$. Then each of these firms obtains expected profits $\frac{1}{N}s^{\min} + \frac{N-1}{N} \cdot \Pi_T^S$. If it chooses $s_i > r$ some other firm is taken over and profits increase to Π_T^S .

(a2) If every firm plays $s_i^{**} = \Pi_T^S$, each one of them is taken over with positive probability, but it obtains profits Π_T^S whether it is taken over or not. Reducing s_i would mean that the firm is taken over with probability 1. Increasing s_i would mean the firm is definitely not taken over but profits are still Π_T^S . Pareto-dominance follows immediately from $\Pi_{NT}^S > r \geq \Pi_T^S$. The strategy s_i^{**} is weakly dominated by $s'_i = \Pi_{NT}^S$. s_i^{**} gives profits of Π_T^S with certainty. Deviation to $s'_i = \Pi_{NT}^S > r$ will give profits of Π_{NT}^S if there is no takeover and Π_T^S if there is.

(b1) The proposed strategy combination is an equilibrium. If firm i sets $s_i = r$, it can obviously not increase its profits by reducing s_i (i.e., selling itself at a lower price). Increasing s_i would mean there is no takeover and profits would fall to Π_{NT}^S . The other firms could only change their payoffs by setting $s_j \leq r$. Then they would be taken over with some positive probability, leading to expected payoffs of less than Π_T^S .

Next, there can be no other pure strategy equilibria. First, there can be no pure strategy equilibria with more than one firm charging r or less. Deviation to $s_i > r$ would lead to a profit of Π_T^S , which is more than what they would obtain with a positive probability of being taken over. Second, there can be no equilibrium where exactly one firm sets $s_i < r$, as it could increase its payoff by increasing s_i to r .

Finally, there can be no equilibrium with $s^{\min} > r$. Then firms would obtain Π_{NT}^S , and firms would have an incentive to underbid each other, so as to earn the takeover premium r .

(b2) In this subcase, the proof for the proposed equilibrium strategy is the same as for subcase (a2).

(c) First, this is an equilibrium. As an acquisition takes place if everybody charges $s_i = \Pi_T^S$, firms that are taken over and those that are not earn the

same profit, which cannot be improved upon by deviation. Next, there can be no equilibrium with $s^{\min} \neq \Pi_T^S$. If $s^{\min} > r$, each firm wants to deviate to r to be taken over with certainty. If $r \geq s^{\min} > \Pi_T^S$, each firm wants to deviate slightly below s^{\min} to be taken over with certainty. If $s^{\min} < \Pi_T^S$, the firms offering s^{\min} could avoid being taken over at the low price by increasing their bid to Π_T^S , which would then be their payoff. ■

The intuition is as follows. In case (a), the takeover price is smaller than what small firms obtain in the market when there is no takeover. Thus, there is no incentive to deviate to $s_i \leq r$. In case (b), there are positive acquisition externalities so that small firms prefer a situation where one of their small competitors is taken over to a situation without takeover. On the other hand, when $r < \Pi_T^S$, they prefer some other firm to be taken over; the "chicken" outcome is thus natural. Finally, with the high reservation price in (c), each firm wants to be taken over: standing alone, it would earn Π_T^S or Π_{NT}^S , depending on whether some other firm is taken over or not, that is, in any case, less than the reservation price.

The consequences of lemma 1 are as follows. In case (a), it is relatively safe to argue that, even though it exists, the equilibrium where a firm is taken over is implausible, as it is both Pareto-inefficient and in weakly dominated strategies. Thus, the most plausible prediction is that there is no takeover. In case (b), the various equilibria are equivalent from the point of view of the acquiring firm, as the takeover prices are identical and the firm does not care which competitor it acquires. Thus, if one believes that one of the pure strategy Nash equilibria is chosen, the relevant prediction is that there is takeover at price r . One might argue, however, that mixed strategy equilibria are more plausible in this case. Such equilibria would have small firms randomizing between r and Π_T^S , leaving the possibility that there is no takeover. In case (c), the only pure strategy equilibrium is in weakly dominated strategies. However, this equilibrium can be approximated by a sequence of equilibria of discrete games that are not weakly dominated. Thus, in spite of some reservations, we take this weakly dominated equilibrium as the prediction.³⁹

³⁹This equilibrium is as good or as bad as an ordinary Bertrand equilibrium which is also weakly dominated, but the discrete approximation of non-dominated equilibria (Mas-

We now define the takeover price to be the lowest level of r for which a takeover will occur in the selected Nash equilibrium of the acquisition cost game. First, suppose $\Pi_{NT}^S < \Pi_T^S$. Then, for any r that is slightly above Π_{NT}^S , takeover takes place by part (b) of lemma 1. Thus Π_{NT}^S is a natural approximation of the takeover price. On the other hand, if $\Pi_T^S \leq \Pi_{NT}^S$, the takeover price is Π_T^S by part (c) of lemma 1. Summing up, we obtain the following result, stated as a corollary.

Corollary 2 *Acquisition costs, as determined by the equilibrium of the acquisition game, amount to $AC(Y_1^{t-1} - 1, F^{t-1} - 1) = \min\{\Pi_T^S, \Pi_{NT}^S\}$.*

Colell et al. 1995).

9 References

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| | | |
|------------------------|--|---|
| | Entrant \longrightarrow | |
| \downarrow Incumbent | $a_2 = 0$ | $a_2 = 1$ |
| $a_1 = 0$ | $\Pi^L(Y_1^0, F^0), 0$ | $\Pi^L(Y_1^0, F^0 + 1),$ $\Pi^S(Y_1^0, F^0 + 1) - E$ |
| $a_1 = 1$ | $\Pi^L(Y_1^0 + 1, F^0 - 1) -$ $AC(Y_1^0 + 1, F^0 - 1), 0$ | $\Pi^L(Y_1^0 + 1, F^0) -$ $AC(Y_1^0 + 1, F^0),$ $\Pi^S(Y_1^0 + 1, F^0) - E$ |

Table 1: The Payoff-Matrix for the One-Shot Game

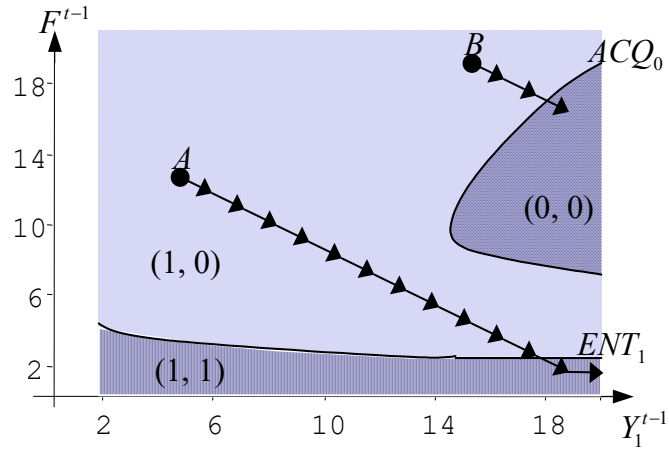


Figure 1: Pure Strategy Equilibria in the Static Synergy Game

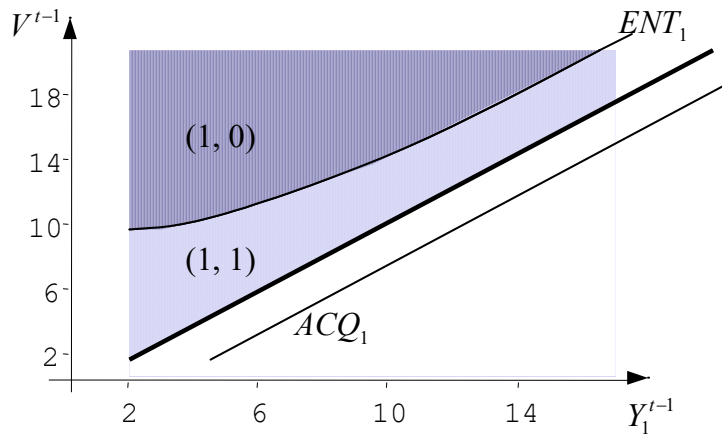


Figure 2: Pure Strategy Equilibria in the Merger for Variety Game