SCREENING AND MERGER ACTIVITY

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Abstract

In our paper targets, by setting a reserve price, screen acquirers on their (expected) ability to generate merger-specific synergies. Both empirical evidence and many merger models suggest that the difference between high- and low-synergy mergers becomes smaller during booms. Thus, the target's opportunity cost for sorting out relatively less fitting acquirers increases and, hence, targets screen less tightly during booms, which leads to a hike in merger activity. Our screening mechanism not only predicts that merger activity

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is intense during booms and subdued during recessions but is also consistent with other stylized facts about takeovers and generates novel testable predictions.

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I. INTRODUCTION

The existence of periods of intense merger activity, typically referred to as merger waves, is well documented (see e.g. Andrade and Stafford [2004]). Merger activity usually heats up during economic booms and slows down in recessions (see e.g. Maksimovic and Phillips [2001]). Empirical papers point to various exogenous factors, like technological innovations or demand booms, as triggers of merger waves. Economic merger theories predict that when economic conditions are better, mergers are more profitable and therefore more likely to occur (see Harford [2005] for a discussion of these theories and related evidence). These theories, however, do not address a number of stylized merger facts. For example, they do not explain why wave mergers are, on average, less efficient (Rosen [2006]) or why initiated mergers are more likely to be abandoned during downturns (see Figure 1).[1]

We propose a merger screening mechanism that—despite its simplicity—is consistent with stylized facts about mergers, and provides novel testable predictions. In our model, the acquirer possesses more information about the synergy gains than the target (as, for example, in Hirshleifer and Titman [1990] and Shleifer and Vishny [1986]). Following the reasoning in Cramton [1998], we model the impact of defense tactics by supposing that the target can commit to a reserve price (as in Jehiel and Moldovanu [2000] and Inderst and Wey [2004]). When setting this reserve price, the target faces the following trade-off: by requesting a high reserve price, it extracts more merger rents whenever the post-merger synergy gains are high.[2] When doing so, however, the target does not sell whenever the acquirer turns out to be a relatively bad fit.[3] The target thus compares the

[1]Figure 1 indicates that during the period 1990-2005 the relative number of merger abandonments in the US was higher when economic conditions (as measured by quarterly growth in GDP) were worse. The negative correlation of -0.35 is statistically significant at a 1% level.

[2]The takeover of PeopleSoft by Oracle in 2004 fits this setup. Oracle launched a bid in February offering $21/share. PeopleSoft in response triggered a poison pill and a "Customer Assurance Program", specifying money-back guarantees for customers if PeopleSoft were acquired by Oracle or SAP. Oracle and PeopleSoft finally agreed in December on a takeover price of $26.5/share.

[3]The failed takeover of Salix by Axcan, two Canadian pharmaceuticals, fits this setup. Salix shareholders allowed the use of a poison pill, stating that "Mergers and acquisitions must be considered, but one thing we cannot do is allow someone to buy us on the cheap". Axcan initiated a takeover of Salix in

gains of setting a high price—and thereby screening the acquirers—to setting a low price and selling for certain—i.e. pooling the acquirers.[4]

We assume that during a boom efficiency gains become relatively less important and, hence, high-type mergers become relatively more similar to low-type mergers. This raises the opportunity cost of sorting out relatively inefficient acquirers as their relative value increases. During booms the target, therefore, sets a reserve price that is acceptable to both high- and low-type acquirers—leading to a hike in mergers. Thus, an upward shift in the economic conditions causes a lack of screening and, as a consequence, a merger "cluster" or merger "wave" occurs.

Hence, central to the theoretical argument is the following: improvements in the economic environment make synergy gains relatively less important in the sense that profits of high- and low-type mergers become relatively more similar. This assumption is in line with empirical evidence, which indicates that during booms output shares are reallocated from more productive to less productive firms, so that the latter produce relatively more (Lee [2007]; Eisfeldt and Rampini [2006]). Applying Boone's [2000, 2008] results on output reallocation and competition, this suggests that low-type merged firms are punished less harshly for being inefficient when economic conditions are better, and hence earn profits that are relatively more similar to those of high types. We also show below that this assumption is satisfied in most of the commonly used horizontal merger models.[5]

The screening mechanism not only helps to explain procyclical spikes in merger activity

April 2003. Due to Salix defense tactics Axcan finally abandoned its attempt in June, although having raised the bid several times in between.

[4]The use of defense tactics as a screening device is consistent with empirical evidence. Comment and Schwert [1995] show that defense tactics lead to higher takeover prices, but also induce some acquirers to abandon initiated mergers.

[5]A noteworthy exception is the homogenous-good constant marginal cost Cournot model in which a merger is equivalent to the closure of the less efficient firm. This model provides a rationale for excess capacity-reducing mergers and can be used to explain merger clustering in troubled industries (Fauli-Oller [2000]). Cournot models satisfy our assumption if mergers absent efficiency gains are profitable, as is often the case with product differentiation or increasing marginal costs (Perry and Porter [1985]).

but also predicts that relatively more mergers are abandoned during worse economic conditions (Figure 1). In addition, more efficient acquirers should extract higher rents during booms. This is consistent with evidence that, in a merger wave, bidders gain on average higher (short term) abnormal returns than bidders outside a wave (Harford [2003], Gugler et al. [2006] and Rosen [2006]). The lack of screening during booms also explains why, on average, wave mergers are less efficient than non-wave mergers. Indeed, in the long run, wave mergers perform significantly worse, as Gugler et al. [2006], Harford [2003] and Rosen [2006] document. In our model, merged entities may even be less efficient than non-merging firms—consistent with empirical evidence in Carow et al. [2004].

Other recent theoretical work has made advances in explaining the procyclicality of merger activity. The first strand, to which we refer to as "economic shock" theories, relies on economic fundamentals. Lambrecht [2004] shows that when merger synergies are an increasing function of a stochastic product market demand, each firm's payoff from merging has features similar to call options. Firms therefore have an incentive to merge—exert their option—in periods of economic expansion. Toxvaerd [2008a] shows that if an increase in economic fundamentals increases the number of expected future mergers, this can induce preemptive mergers, leading to cluster effects. Jovanovic and Rousseau [2002] argue that technological shocks lead to a higher dispersion of efficiency, which leads to a reallocation of physical assets from less efficient targets to more efficient acquirers.[6]

The second strand of literature, called "misvaluation" theories, builds on stock market misvaluations. Shleifer and Vishny [2003] argue that acquirers with temporary overvalued shares interchange these shares for real assets of undervalued targets, which targets are willing to accept due to having shorter time horizons. Rhodes-Kropf and Viswanathan [2004] develop a model of uncertainty about sources of misvaluation. Targets with imperfect information will accept more bids from overvalued bidders during market valuation

[6]Rhodes-Kropf and Robinson [2008], on the other hand, claim that mergers occur between firms with similar efficiencies and complementary assets. Since search costs are lower in booms, more assortative matching occurs because firms search longer for a partner. Toxvaerd [2008b] shows that unrelated firms can decrease their exposure to risk and enhance debt capacity by merging. During a financial boom, i.e. when intermediary capital is abundant (and thus cheaper), he predicts more merger activity.

peaks because they overestimate synergies during these periods. Similar to ours, the above mentioned theories find pro-cyclical merger clustering. We highlight the observable differences between our predictions and those of these existing theories in Section V below.

The paper is structured as follows. In the next section, we introduce the model. Section III establishes our screening mechanism, first based on one potential acquirer per merger-match and then with multiple potential acquirers. Section IV discusses our predictions. Finally, in Section V, we conclude. All proofs are relegated to the Appendix.

II. MODEL

We now introduce a simple takeover process in a general model of firm competition. In the subsection thereafter, we relate the merging profits to the state of the economy and state our main assumptions. We argue that these assumptions are consistent with the existing empirical evidence and, in the final subsection, we show that they are also satisfied by a wide variety of horizontal merger models.

II(i). A SIMPLE TAKEOVER PROCESS

A given firm, "the acquirer", is interested in buying another firm, "the target".[7] There are two types of potential acquirers, one that is of a good fit—i.e. one that should be able to realize high synergies from merging with the target ("high type")—and one that is less fitting ("low type").[8] Let π^H and π^L be the post-merger joint profits if the acquirer is of high and low type, respectively, with $\pi^H > \pi^L$. Let π^T be the target's and π^A the acquirer's profit in the absence of a merger. We denote the net merger gain of a high-type

[7] We follow much of the literature (e.g. Inderst and Wey [2004] and Toxvaerd [2008a]) in assuming that there are exogenously assigned target(s) and acquirer(s). While it would be interesting to also endogenize whether to take over or being taken over, the exogenous case is an important and realistic one. It seems appropriate when some firms—the potential acquirers—are at a point in time higher valued (Shleifer and Vishny [2003], Rhodes-Kropf and Viswanathan [2004]), more productive (Jovanovic and Rousseau [2002]), and/or better managed (Lambrecht and Myers [2007]) than others —the potential targets.

[8] We present the two-type model but our insights are replicable for continuous distributions of types.

merger by $\Delta\pi^H$, i.e. $\Delta\pi^H \equiv \pi^H - (\pi^T + \pi^A)$. Similarly, let $\Delta\pi^L$ be the net merger gain of a low-type merger.

The acquirer has informational advantages about the profitability of the transaction (Hirshleifer and Titman [1990], Shleifer and Vishny [1986]). Indeed, having better information is consistent with acquirers being, on average, substantially larger, older, and more experienced in merger activities than targets (see e.g. Rhodes-Kropf et al. [2005]). Furthermore, because the acquirer is in charge of post-merger operations and synergy realizations, we believe it is natural to presume that the acquirer has a more accurate assessment of the possible synergies. Formally, the common prior probability that the acquirer is a high type is $q \in (0, 1)$. Prior to the merger process, however, the acquirer receives an informative signal about whether it is a high- or a low-type acquirer. For simplicity, we focus on the extreme case in which the acquirer receives a perfect private signal, while the target receives no, or a completely uninformative, signal.

The target, however, extracts information by setting a price, r, at which it is willing to sell the company. As for example in Jehiel and Moldovanu [2000], Inderst and Wey [2004], and Povel and Singh [2006],[9] we thus assume that the target can commit to an optimal reserve price.[10] In line with our screening theory, Comment and Schwert [1995], among others, show that defense tactics (i) lead to higher takeover prices when the takeover takes place, but (ii) also force some acquirers to abandon mergers they had previously initiated. Overall, however, takeover defenses appear to be successful devices: takeover premia are higher on average, even after taking into account abandonments.[11]

The timing of the takeover process is as follows. First, the target sets a reserve price at which it is willing to sell the company. Second, the acquirer either accepts

[9]Povel and Singh [2006] assume that one of the potential bidders has superior information about the target and investigate the optimal selling procedure in this case, which can be implemented as a sequential auction that may require a reserve price.

[10]Cramton [1998] points out: "A target's board has a great deal of discretion in establishing procedures... This power arises from the target's prior issuance of a poison pill... Poison pills afford the board a (limited) ability to set a reserve price."

[11]Other commentators, however, have argued that takeover defenses might also be used for the benefit of the target's management, while being harmful for its shareholders (Heron and Lie [2006]).

or rejects. If it accepts, the merger is carried out—i.e. the target receives a payoff of r and the acquirer obtains the target's production facility. Otherwise, the merger is abandoned. Notice that by allowing the target to make a take-it-or-leave-it offer, we choose the simplest incomplete information bargaining model that is consistent with the target having substantial bargaining power.[12]

II(ii). MERGER GAINS AND ECONOMIC CONDITIONS

Profits from merging, as well as the profits in the absence of a merger, depend on the underlying economic conditions (e.g. consumer demands, production costs, etc.). Let the economic conditions be parameterized by a real variable $b \in [b_{\min}, b_{\max}]$ with the interpretation that firms' profits—with and without a merger—are higher if b is greater. For a given economic condition b, we denote the high- and low-type merger gains by $\Delta\pi^H(b)$ and $\Delta\pi^L(b)$, respectively, with $\Delta\pi^H(b)$ and $\Delta\pi^L(b)$ being continuously differentiable and $\Delta\pi^H(b) > \Delta\pi^L(b)$ for any b.

We next present the two assumptions that drive our main results. They specify a relation between the gains from merging and economic conditions in a general framework, without specifying a market model. Below in Section II(iii)., we will show that these conditions are satisfied for a variety of oligopolistic merger models.

Our first condition postulates that net profit differences between high- and low-type mergers are less pronounced when economic conditions are better.

Assumption 1 *The ratio between the net merger gains of a high-type merger and a low-type merger decreases as the economic condition b becomes better. Whenever $\Delta\pi^L(b) \neq 0$,*

$$\frac{\partial}{\partial b}\frac{\Delta\pi^H(b)}{\Delta\pi^L(b)} < 0. \tag{1}$$

To understand the empirical motivation behind this assumption, recall results by Boone [2000, 2008] who shows that firms are punished more harshly for being inefficient

[12]Defense tactics enhance the bargaining power of the target with respect to the acquirers. Fuller et al. [2002] state that "In the 1980s, takeover defenses adopted by firms, state antitakeover laws, and judicial decisions protecting targets all developed to further shift the bargaining balance from bidders to targets".

in more "competitive markets", which he defines as markets with relatively more output reallocation from less efficient to more efficient firms. In particular, Boone [2000] shows in a number of specific horizontal market models that the relative profits of an efficient firm with respect to a less efficient firm are increasing in the level of reallocation. Boone [2008] then shows in a general framework that the relative profit differences of an efficient firm and a less efficient firm—with respect to a third firm in the industry—are also increasing in the level of reallocation. Given that more output reallocation coincides with worsening economic conditions (Lee [2007], Eisfeldt and Rampini [2006]),[13] our condition can be viewed as adopting Boone's [2008] result to a merger context. That is, we postulate that the net profits of a (hypothetical) high-type merger increases relative to those of a (hypothetical) low-type merger when economic conditions become worse—consistent with the empirical observation that relatively more output is reallocated towards high-type firms when economic conditions are worse.

Our second condition states that if a given high-type merger is profitable for a certain economic condition, then it is strictly profitable when economic conditions are better.

Assumption 2 *If a high-type merger is profitable for a given economic condition* b, $\Delta\pi^H(b) \geq 0$, *then it is strictly profitable for any economic condition* $b' > b$.

II(iii). EXAMPLES OF MERGER MODELS

In the previous subsection, we argued that our main Assumption 1 is consistent with the empirical findings on the intensity of competition during booms and recessions. In this subsection, we show that this assumption is naturally satisfied by a wide variety of

[13] Lee [2007, p.1] finds that: "Output shares are reallocated from less-productive to more-productive plants during recessions, so that during recessions, less productive firms produce less of the total output, but during expansions they produce more." Eisfeldt and Rampini [2006, p.371] state that: "Our finding of countercyclical productivity dispersion across firms and sectors adds to the empirical support for increases in heterogeneity in recessions.". An increased output dispersion in downturns in favor of the more efficient firms is also consistent with the so-called "cleansing effect" of downturns, predicted by, among others, Caballero and Hammour [1994].

horizontal merger models.[14]

Before introducing specific merger models, let us give a general intuitive explanation of which qualitative features of market competition coincide with our main assumption. Better economic conditions enlarge the size of the market, i.e. the "pie", to be distributed between competitors. Both the merged firm—whether low or high type—and outsiders gain more during better economic conditions. Of course, high-type mergers gain a larger share of this pie than low-type mergers. What potentially changes with better economic conditions, however, is *how much* larger a high-type piece of the pie would be relative to a low-type piece. This size-of-the-pie effect is determined by the outsiders' changing reaction towards the merger. In response to better economic conditions, they may either react more aggressively—"aggressive" being defined by increasing production or decreasing prices in response to a merger—or react more softly—"soft" being defined as decreasing production or increasing prices in response to a merger. A more aggressive response during better economic conditions makes relative merger efficiencies more important and thus high- and low-type mergers more different, while a softer response by outsiders makes them less important. In the latter case, Assumption 1 is satisfied. As we shall show in what follows, the responses by outsiders is determined by the type of competition prevailing in the market.

We now present some classic horizontal merger models—with different types of competition—that satisfy our assumptions and provide a counterexample. For each example in this section, we give details of (i) the market model and (ii) the impact of the merger process. First, we introduce the merger model of Deneckere and Davidson [1985], based on price competition with differentiated goods.

Example 1 Bertrand with differentiated goods (Deneckere and Davidson [1985]): *(i) Consider an industry with n single-product firms competing in prices and producing differentiated products at constant and identical unit costs c. The demand for firm i is given*

[14] Assumption 2 is also naturally satisfied for all our examples, except for a counter-example we provide. In Banal-Estañol et al. [2009] we also provide examples of conglomerate and vertical merger models that satisfy Assumptions 1 and 2.

by $x_i = \frac{1}{n}\left(b - p_i(1+\gamma) + \frac{\gamma}{n}\Sigma_{j=1}^{n} p_j\right)$*, where* $b > c$*, and* $\gamma > 0$ *represents the degree of substitutability between the n products.*[15] *(ii) Consider a bilateral merger that reduces the merging firms' marginal cost to either* $\bar{c} < c$ *or* $\underline{c} < \bar{c} < c$*.*

In the case of price competition, when the pie is larger, outsiders increase prices more and thus react less aggressively in response to a merger. The demand faced by the outsiders of the merged entity increases as a consequence of the merger. We explain the mechanism here. If economic conditions are better and the degree of substitutability between products remains unchanged in absolute terms, that is, the slope of the demand curve is unchanged, then a price increase induces the same volume of sales reduction as before. But since the volume of sales has increased, the *percentage* reduction in demand is now lower, and outsiders are thus induced to increase prices more (see Ivaldi et al. [2003], for this rationale). Better economic conditions, therefore, induce outsiders to behave less aggressively and Assumption 1 is satisfied.

We next discuss a simple, but fairly general, multi-product setup in which a merger involves up-front restructuring costs. A special case of this setup is Salop's circular-city model with quadratic transportation costs.

Example 2 Multiplicative demand *(i) Consider a differentiated-product industry with n multi-product firms that compete in prices. Let* $x_l(p, b) = bx_l(p)$ *be the demand for a product l for a given price vector p and economic condition* $b > 0$*. Let* c_l *be the constant unit cost of producing good l. Suppose—as will be the case for a well-behaved demand system—that a unique equilibrium price vector always exists. (ii) Consider a bilateral merger that requires fixed restructuring costs* $R > 0$ *and leads to a vector of marginal costs that is either* $\underline{c}$ *or* $\bar{c}$*. Suppose that high-type mergers are profitable for some economic condition b.*

If outsiders react in the same way towards a merger when the pie becomes larger, as is the case for a multiplicative demand, the relative shares for high- and low-type mergers

[15] As is well-known, this demand function can be obtained from a representative agent with a specific quasi-linear utility function.

remain constant across changing economic conditions. But, under the realistic assumption that mergers involve fixed restructuring costs, relative net profits become more similar for better economic conditions.[16] To see how restructuring costs work in favor of Assumption 1, denote the gross gains from a high- and low-type merger as $\Delta\underline{\pi}^H(b)$ and $\Delta\underline{\pi}^L(b)$ and the net gains as $\Delta\underline{\pi}^H(b) - R$ and $\Delta\underline{\pi}^L(b) - R$, where R stands for the fixed restructuring costs. It is easy to show that

$$\frac{\partial}{\partial b}\frac{\Delta\underline{\pi}^H(b) - R}{\Delta\underline{\pi}^L(b) - R} = \left(\frac{\partial}{\partial b}\frac{\Delta\underline{\pi}^H(b)}{\Delta\underline{\pi}^L(b)}\right) \frac{\Delta\underline{\pi}^L(b)}{\Delta\underline{\pi}^L(b) - R} + \left(\frac{\partial}{\partial b}\frac{R}{\Delta\underline{\pi}^L(b)}\right) \left(\frac{\Delta\underline{\pi}^H(b)}{\Delta\underline{\pi}^L(b)} - 1\right)\left(\frac{\Delta\underline{\pi}^L(b)}{\Delta\underline{\pi}^L(b) - R}\right)^2.$$

If the relative gross gains are constant—as is the case with multiplicative demand— the relative net gains are decreasing: formally, the relative net gains are decreasing since the first summand on the right-hand side is zero (its first term is zero) and the second summand is negative (its first term is negative and the other two are positive). More generally, the fact that restructuring costs work in favor of Assumption 1 extends to other specifications of demand and other modes of competition. Even if the relative gross gains are increasing and the first summand above is positive, the relative net gains are negative if the second summand is sufficiently negative. Intuitively, fixed restructuring costs favor high-type mergers as these costs can be recouped through a greater sales volume. As economic conditions become better and firms sell more, the fixed restructuring costs become less important and thus high- and low-type mergers more similar.

We continue with a stylized (behavioral) model of quantity competition. In this model, a better economic condition could be characterized not only by a higher demand, but also by a reduction in the marginal cost c.

Example 3 Conjectural variations (Kwoka [1989]): *(a) Consider an industry with n single-product firms producing differentiated products at constant and identical unit costs c. The inverse demand for firm i is given by $p_i = b - \Sigma_{j=1}^n q_j$, where $b > c$. Suppose that the sum of the rivals' reactions to an increase in a firm's quantity, i.e. $V \equiv \Sigma_{j=1,j\neq i}^n \frac{\partial q_j}{\partial q_i}$,*

[16] Lambrecht [2004], for example, highlights that mergers involve significant one-off costs, such as legal fees, fees to investment banks and other merger promoters, and the costs of restructuring and integrating the two companies.

is constant across firms, and equal before and after a merger. (ii) Consider a bilateral merger that changes the marginal costs of the merging firms to either $\underline{c} < c$ *or* $\bar{c} > \underline{c}$*. Finally, suppose that the conjectural variations are sufficiently high such that mergers are profitable absent efficiency gains.*

The assumption that mergers absent efficiency gains are profitable is not innocuous. For example, Cournot competition is a special case of the above setup where $V = 0$ and as demonstrated in Salant et al. [1983], a bilateral merger absent efficiency gains is unprofitable for $n \geq 3$. Assumption 1 does not hold in this particular model.

Counter-Example 1 Cournot with homogenous goods (Salant et al. [1983]):*(i) Consider an industry with* 3 *firms competing in quantities and producing, at constant and identical unit costs c, homogeneous products. The inverse demand for firm i is given by* $p_i = b - d\ \Sigma_{j=1}^{n} q_j$ *where* $b > c$*. (ii) Consider a bilateral merger that changes the marginal costs to* $\underline{c} < c$ *or* $\bar{c} > \underline{c}$*.*

Indeed, when firms compete "fiercely" in quantities, which is the case for Cournot competition with homogenous products and constant marginal costs, a larger pie induces outsiders to increase production by more and, thus, to react more aggressively. As the above counterexample illustrates, if firms compete à la Cournot, merger waves due to less screening may therefore not coincide with better economic conditions.[17]

If, however, due to convexities in the cost function or product differentiation, mergers that do not induce efficiency gains are profitable in a Cournot setup, then our mechanism again holds, as we illustrate in the next two examples.[18] As noted by Perry and

[17]The most common interpretation of the "constant-marginal-cost" Cournot merger model is that the merger leads to the closure of the less efficient merger participant (see Perry and Porter [1985]). From this perspective, Fauli-Oller [2000] provides a rationale for the elimination of excess capacity in declining industries. A case study of Dutz [1989] and casual evidence in Lambrecht and Myers [2007] indicate that this has occurred in some particular troubled industries. The systematic evidence on merger waves, however, clearly indicates that merger activity is on average highly procycliclal (see e.g. Gugler et al. [2006]).

[18]The Cournot model with homogeneous goods and linear increasing marginal costs is equivalent to

Porter [1985], increasing marginal costs (or, equivalently, product differentiation, see Vives [2002]) are crucial for yielding sensible descriptions of mergers in a Cournot framework, because the new entity then produces at a lower cost (or sells more products) than either of the merging firms. In this case, the merging firms are sufficiently insulated from competition—due to increasing marginal costs or product differentiation—and a merger then induces a relatively less aggressive response from outsiders as the economic conditions improve, which makes that Assumption 1 holds again.

Example 4 Cournot with increasing marginal costs (Perry and Porter [1985]): *(i) Consider an industry with n firms competing in quantities and producing with linear and strictly increasing marginal costs, $c + \lambda q_i$. The inverse demand for firm i is given by $p_i = b - \Sigma q_j$. (ii) Consider a bilateral merger that reduces the intercept of merging firms' marginal cost to either $\bar{c} < c$ or $\underline{c} < \bar{c} < c$. Finally, suppose that the cost functions are sufficiently convex so that mergers are profitable absent efficiency gains.*

Example 5 Cournot with differentiated goods: *(i) Consider an industry with n firms competing in quantities and producing, at constant and identical unit costs c, differentiated products. The inverse demand for firm i is given by $p_i = b - (1 + \frac{\lambda}{2})q_i - \Sigma_{j \neq i} q_j$ where $b > c$ and λ represents the (symmetric) degree of differentiation between the products. (ii) Consider a bilateral merger that reduces the merging firms marginal cost to either $\bar{c} < c$ or $\underline{c} < \bar{c} < c$. Finally, suppose that the product differentiation is sufficiently high so that mergers are profitable absent efficiency gains.*

We next summarize which horizontal market models satisfy our assumptions.

Proposition 1 *The horizontal market models introduced in Examples 1, 2, 3, 4, and 5 satisfy Assumptions (1) and (2).*

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a Cournot market with product differentiation and constant marginal costs (Vives [2002]). Indeed, the profits of a firm i in the case of increasing marginal costs, $\pi_i = (b - q_i - \Sigma_{j \neq i} q_j)\, q_i - (c + \frac{\lambda}{2} q_i)\, q_i$, can be rewritten as $\pi_i = \left(b - (1 + \frac{\lambda}{2})q_i - \Sigma_{j \neq i} q_j\right) q_i - c\, q_i$, which are the profits of a firm i in the case of differentiated products.

III. SCREENING AND MERGER CLUSTERS

We first present the case of one acquirer, which shows how our mechanism works. We then discuss the case with multiple bidders and targets, which confirms the main intuition.

III(i). ONE POTENTIAL ACQUIRER

We now explain how the "bare bones" of our screening mechanism work, assuming that all mergers are profitable. This highlights the two main differences between our framework and the economic shock theories. First, in our mechanism, some profitable mergers are abandoned. Second, it is unnecessary for mergers to become *more* profitable as economic conditions improve.

Proposition 2 *If Assumption 1 is satisfied and mergers are profitable for any economic condition, i.e.* $\Delta\pi^L(b) \geq 0$ *for any* b*, then there exists* $\overline{b} \in [b_{\min}, b_{\max}]$ *such that if* $b < \overline{b}$ *only high-type mergers take place, whereas if* $b > \overline{b}$ *all mergers take place.*

Although mergers with both types of acquirers are profitable, the target might set a reserve price that does not accommodate low-type acquirers. By screening the acquirer through a high reserve price, the target can extract all post-merger efficiency gains if it, indeed, meets a high-type acquirer. But, by doing so, the target runs the risk that the takeover will be abandoned because low-type acquirers are unwilling to pay such a high reserve price. On the other hand, to ensure that the takeover gets consummated, the target needs to set a low reserve price, which all types of acquirers are willing to accept.

If the economic conditions are "worse", $b < \overline{b}$, the merger gains with a low-type acquirer are small and, hence, the opportunity cost of setting a high price is low. The target thus screens acquirers when the economic conditions are sufficiently bad. As the economic conditions become better, high- and low-type mergers become more similar (Assumption 1). Setting a price that is also acceptable to low-type acquirers therefore becomes more and more attractive as low types become relatively more similar to high types. Thus, above a critical economic condition, $b > \overline{b}$, the target strictly prefers to

set a pooling reserve price. This has two immediate implications. As the economic conditions improve, targets become less selective and, hence, also merge with acquirers with lower synergy gains. Also, because better economic conditions imply less screening, the (average) reserve price is lower than if the target had complete information about the synergy gains.

In a second step, using Assumptions 1 and 2, we present our main result, which accommodates a "full wave"—i.e. an increase from no merger activity to maximum merger activity when economic conditions improve.

Proposition 3 *If Assumptions 1 and 2 are satisfied, there exist* $\underline{b}$ *and* $\overline{b} \in [b_{\min}, b_{\max}]$ *such that if* $b < \underline{b}$ *no merger takes place, if* $\underline{b} < b < \overline{b}$ *only high-type mergers take place, and if* $b > \overline{b}$ *all mergers take place.*

Thus, our screening model predicts that as economic conditions improve target firms set a reserve price such that no, some, or all acquirers find it acceptable. At first, for bad economic conditions, mergers are unprofitable and, hence, any merger would involve losses for either the target or the acquirer, or both. The target sets a reserve price that is unacceptably high for any acquirer. For better economic conditions, the target sets a separating, and for even better conditions, a pooling reserve price.

Since all the examples introduced in the previous section satisfy Assumptions 1 and 2, an immediate consequence of Proposition 3 is:

Corollary 1 *In the horizontal merger models in Examples 1, 2, 3, 4, and 5, there is less screening and higher merger activity during economic booms.*

The proposed screening mechanism is consistent with the fact that relatively more mergers are abandoned during relatively worse economic conditions (see Figure 1). Think of a potential acquirer who approaches a target and then engages in a careful evaluation of the target. During the evaluation the potential acquirer realizes that he is a low-type acquirer but still expects the merger to be profitable. During bad economic conditions, the target sets a high reserve price so that a low-type acquirer will abandon the merger.

In contrast, when the economic conditions are better, the reserve price is chosen so that all potential acquirers find it acceptable. This predicts not only more mergers but also that fewer previously initiated mergers are abandoned.

III(ii). MULTIPLE BIDDERS

Andrade et al. [2001] describe the prototypical takeover in the 1990s as a transaction with one publicly bidding firm. Boone and Mulherin [2007], however, report that around half of the 400 transactions in their 1990s sample were privately auctioned among multiple bidders prior to the public announcement of takeover bids. In this subsection, we extend our model to accommodate for multiple bidders. Motivated by evidence, we take the number of *potential* bidders as an exogenous factor that is independent of economic conditions.[19]

Suppose there are n potential bidders and that the efficiency gains from a merger are independently distributed across these bidders. With probability q the potential bidder is of a high type and with probability $1-q$ of a low type. This setup rules out externalities between bidders, which would arise naturally if both potential acquirers and the target compete in the same industry—we briefly discuss this case afterwards. For simplicity, we model the takeover process as a second-price sealed-bid auction with a publicly known reserve price, which is set by the target. We focus on equilibria in which bidders use weakly undominated bidding strategies in all bidding subgames.

Proposition 4 *Consider the case with n potential bidders and no bidding externalities. If Assumptions 1 and 2 are satisfied, there exist* $\underline{b}$ *and* $\overline{b}(n) \in [b_{\min}, b_{\max}]$ *such that if* $b < \underline{b}$,

[19] Despite containing the recession of the early 1990s and the economic boom of the mid-to-late 1990s, the proportion of multi-bidder auctions and single-bidder negotiations in Boone and Mulherin's [2007] sample is constant over time. They argue that the choice between a negotiation and an auction depends on the "information costs" of organizing an auction. The costs of giving away confidential information to multiple bidders can outweigh the potentially higher auction revenues. Industry factors such as the level of R&D and product standardization, for instance, are important determinants of these costs (Shleifer and Vishny [1992]).

no merger takes place, if $\underline{b} < b < \overline{b}(n)$*, only high-type mergers take place, and if* $b > \overline{b}(n)$*, all mergers take place.*

This result allows us to investigate how the thresholds are related to the market conditions via the number of potential bidders. First, $\underline{b}$ does not depend on the number of potential bidders. When the high-type merger becomes profitable, the target sets the reserve price such that all high types would accept. The choice between separating or pooling, however, depends on the number of potential bidders. There are two effects at play. First, the higher the number of potential bidders, the lower the probability that all of these are of low type; thus, the probability of being able to sell when setting a separating price increases with the number of potential bidders. This effect induces the separating threshold $\overline{b}(n)$ to decrease with a higher number of potential bidders. Second, the higher the number of potential bidders, the higher the probability that two potential bidders are of high type, which would lead to a beneficial bidding war if a pooling price is set. This effect tends to increase the threshold $\overline{b}(n)$ for a higher number of potential bidders. The first effect, however, dominates the second. Intuitively, the possibility of not selling with a separating reserve price is only relevant if all bidders are of low type, whereas a pooling price induces no bidding war both when all bidders are low type and when all but one are of low type. Since the probability of having no bidding war is reduced more slowly as n increases, separating becomes more attractive.

Corollary 2 *Consider the case with* n *potential bidders and no bidding externalities. While* $\underline{b}$ *is independent of* n*,* $\overline{b}(n)$ *is increasing in* n*.*

Fixing the economic condition, the result implies that for a given n the target may prefer to attract a bid from all potential bidders while for a higher n it may only want to attract high-type bids. Therefore, a higher number of potential bidders, by making a separating reserve price more attractive, can lead to a lower number of completed deals.

Multiple targets. We have assumed that each target has an independent pool of bidders at its disposal, thereby ignoring competition for acquirers. Suppose now, as an

example, that two targets face three potential acquirers, which with a given independent probability are an equally good fit with both targets and with the complementary probability an equally low fit with both targets. As before, think of the takeover market as a second-price sealed-bid auction in which targets simultaneously set reserve prices. For better economic conditions, both setting a pooling reserve price is an equilibrium because, as in the single-target case, one wants to ensure a sale if high- and low-type bidders are similar. Instead, if economic conditions are slightly worse, targets must select mixed strategies in equilibrium. Essentially, both targets setting the separating reserve price is not an equilibrium; it would be profitable to undercut the other. One setting the separating and the other the pooling price is not an equilibrium either; if a separating is a best response to a pooling then it is better for the one that sets the pooling to raise the price to just below the separating price.

Overall, while competition between targets reduces the optimality of screening acquirers, partial screening still occurs if the economic conditions are intermediate and screening disappears when conditions improve. The only difference to the single-target case, therefore, is that one cannot rule out that targets also put some positive probability on the pooling price for intermediate conditions. Hence, our main insights and predictions carry over. More generally, as long as the number of bidders outnumbers the number of targets, we hypothesize that our mechanism still holds: for bad enough economic conditions no merger occurs, for intermediate conditions targets (partially) screen, and for high enough economic conditions, all targets prefer to set a pooling reserve price.[20]

Externalities. We have abstracted from externalities between the potential acquirers. Takeover games with product market externalities are subtle (Jehiel and Moldovanu [2000]) and have been extensively discussed in the merger literature.[21] We briefly identify some conditions under which our single-target results extend to the case of externalities.

[20] On the other hand, if the competition between targets becomes too fierce—e.g if there are two targets and only one potential bidder—then Bertrand-type reasoning implies that targets set a reserve price $\pi^T(b)$ and all profitable mergers occur.

[21] Even absent screening considerations, either profitable mergers might not occur (Inderst and Wey [2004]) or unprofitable mergers might occur (Fridolfsson and Stennek [2005]).

Consider first the case of negative externalities between bidders. As compared to the case of no externalities, acquirers have a higher willingness to pay for the target since becoming an outsider is now worse. This entices acquirers to submit higher bids, increasing the revenues for the target, both if it sets a pooling or a separating reserve price. Moreover, not only the bids but also the separating reserve price might be higher. But, as we formally show in Banal-Estañol et al. [2009], if one compares the target revenues in both cases, there exists again a critical level of the economic condition above which the target prefers a pooling reserve price and below which it prefers a separating reserve price. Thus, better economic conditions again lead to higher merger activity.

Consider now the other polar case in which there are large positive externalities. In this case, there always exists an asymmetric equilibrium in which at most one bidder submits a bid.[22] Intuitively, large positive externalities ensure that if a bidder believes that the rival submits a bid, then it is strictly better to stay an outsider. Indeed, the maximum rent that one can obtain by taking over the target is still lower than the profits of being an outsider. If such an equilibrium is played for all economic conditions, then our results from the single bidder case carry over unchanged.

IV. EMPIRICAL PREDICTIONS

In this section, we highlight the observational consequences of our model, contrast our predictions with those from existing theories, and indicate the cases where existing theories are inconclusive. We furthermore discuss how our predictions match existing empirical evidence.[23] We first relate the relative use of defense tactics and the occurrence of merger

[22]Despite the fact that such asymmetric equlibria require coordination among bidders, they might be more reasonable than symmetric ones in this setting because it can be in the target's interest to favor one buyer over another.

[23]Some empirical evidence is based on merger waves that coincide with periods of high stock markets. These stock market booms, however, are (highly) correlated with economic booms as e.g. Jovanovic and Rousseau [2001] indicate. Moreover, most of the cited evidence is based on merger event studies, and we assume that the stock market reaction to the event of the merger reveals the potential of the merger. However, event studies may suffer from the fact that the merger-event might reveal other information.

abandonments to the economic cycle. From the perspective of economic shock theories, it is unclear why targets would use defense tactics relatively more often in downturns, since acquirers themselves would not initiate mergers when they generate no economic surplus. Similarly, misvaluation theories predict that acquirers themselves would not initiate mergers unless their stocks are overvalued, and thus it is unclear why defense tactics should be employed relatively more often during recessions.

Prediction 1 *Targets use defense tactics relatively more often during economic downturns, i.e. screen more, which leads to relatively more initiated mergers being abandoned.*

For relatively worse economic conditions, the target prefers to set a separating reserve price (Proposition 2) and we expect that, relative to the number of initiated mergers, defense tactics are employed more often. Comment and Schwert [1995] show that the use of defense tactics may induce potential acquirers to abandon proposed mergers. As a result, we therefore predict the observation of more abandoned mergers during downturns. Indeed, as mentioned before, this is consistent with empirical evidence for the US in the period 1990-2005. As shown in Figure 1, relatively more initiated mergers were abandoned in periods with lower quarterly growth. Our model, thus, predicts a combination of these two empirical observations; defense tactics are employed more often in economic downturns, leading to relatively more abandoned mergers.

Second, the target sets a separating reserve price in downturns and a pooling one in booms. As a consequence, we predict that the acquirers earn, on average, more rents during booms because the high-type bidders extract positive rents; this relationship is inversed for targets. It is again unclear what existing theories would predict. For example, in the misvaluation theory by Rhodes-Kropf and Viswanathan [2004], if there is only one (potential) bidder, the acquirer would extract the entire surplus. With multiple bidders, when there is more variance in valuations, the winning bidder should on average receive a higher information rent; on the other hand, if the average valuation of bidders is relatively higher to that of the target, the target benefits more from selling the firm. Similarly, the economic shock theory of Jovanovic and Rousseau [2002] assumes that technological

shocks induce higher ex-ante differences between firms. This may—or may not—lead to a higher share of the surplus for the acquirers.

Prediction 2 *During economic booms, acquirers extract a larger share of the merger surplus than during economic downturns. Targets, in contrast, extract a larger share in economic downturns.*

There is evidence that in a merger wave bidders gain, on average, higher abnormal returns than bidders outside waves. For different specifications of merger waves, Harford [2003], Gugler et al. [2006] and Rosen [2006] discover that an acquirer's short-term stock prices are more likely to increase when a merger is announced in a "hot" merger market. To our knowledge, however, there is no direct evidence on how much targets earn along the business cycle. Therefore, a more complete test would be to analyze whether the merger surplus between acquirer and target is divided differently when economic conditions change.

And third, for better economic conditions, both high- and low-type acquirers are accepted by the target. This lack of screening induces the average quality of consummated mergers to be lower when compared with worse economic conditions.

Prediction 3 *During economic upswings, mergers are on average technologically less efficient than during economic downturns.*

This prediction contrasts with economic shock theories, which predict that better economic conditions lead to more efficiency gains from merging, e.g. due to economies of scale (Lambrecht [2004]) or more efficient firms overturning less efficient firms (Jovanovic and Rousseau [2002]). This prediction, however, coincides with misvaluation theories, which argue that merger intensity correlates with market misvaluation (or "overvaluation"). Rhodes-Kropf et al. [2005] find in an empirical study evidence for misvaluation theories, but state that: "An alternative explanation [of our empirical findings] is that aggregate merger intensity spikes when short-run growth opportunities are high. However, the long-run growth opportunities go in the opposite direction; they are negatively associated with merger intensities." This explanation is consistent with our mechanism if one

relates short-run growth opportunities with economic conditions and long-term growth opportunities with a firm's efficiency.

A direct test would be to measure both pre- and post-merger productivity differences and compare these between economic upswings and downturns. To our knowledge, this test has not yet been directly performed.[24] But one can indirectly relate this prediction with evidence related to firms' stock market performance in the long-run, given that we expect less efficient mergers to perform worse in the long term.[25] For different specifications of merger waves, Harford [2003], Gugler et al. [2006] and Rosen [2006] demonstrate that, in the long-term, wave-mergers perform significantly worse than non-wave mergers. Furthermore, our model is consistent with the finding of Carow et al. [2004] that low-type mergers during waves are less efficient than non-merging firms.

V. CONCLUSIONS

We constructed a model in which the target, by setting a binding reserve price, screens the acquirer on the effectiveness of realizing synergy gains. We argued that in favorable economic environments efficiency gains are relatively less important in realizing merger profits, leading high-synergy mergers to be more similar to less fitting ones. We also showed that this would be predicted by most of the commonly used horizontal merger models. Then, as economic conditions improve, screening out relatively less-fitting acquirers becomes less desirable. Our mechanism, thus, can explain how a positive change in economic fundamentals may generate a spike in merger activity—in line with the observed procyclicality of merger waves. Our results furthermore extend to the case in which several acquirers can bid for the target.

[24] It must be added that Harford [2005] finds a positive effect for wave-mergers on expected long-term performance. He, however, compares specialists' forecasts right before and right after the merger. A priori, though, specialists' forecasts should be as positive as merging firms at the time of merging.

[25] A natural question to ask is why acquirers do not take this into account, and therefore do not refrain from merging. One can extend our framework to account for the possibility that acquirers correctly foresee that current boom periods may be followed by normal periods in the future. Given that future payoffs are discounted, it is easy to argue that our mechanism still survives.

Our screening explanation is not only consistent with a variety of stylized facts about takeovers but also generates a number of novel testable predictions—all of which are based on targets' incentives to screen more during economic downturns. Among these is the prognosis that targets are more likely to rely on defense tactics when economic conditions are relatively worse, which should lead to relatively more initiated mergers being abandoned. We also predict that targets extract a larger share of the merger surplus in economic downturns than during economic booms, and that this relationship is inversed for acquirers. Also, worse conditions induce less acquirers to actively participate in the bidding for a target, given that the reserve price set by the target will be relatively higher.

Other economic shock theories also find pro-cyclical merger clustering. Our screening model, however, differs from these models mainly on two accounts. First, our mechanism predicts that, even when all mergers are profitable, a target may screen acquirers and thereby reject some profitable merger proposals. Second, in contrast to other economic shock theories, our wave-mergers are on average less efficient. Given the high correlation between economic and stock market booms, however, our prediction of less efficient wave-mergers coincides with those of misvaluation theories (see Shleifer and Vishny [2003] and Rhodes-Kropf and Viswanathan [2004]). In contrast to misvaluation theories, we do not rely on systematic stock market misvaluations to predict that wave mergers are less efficient. Also, existing misvaluation theories make no clear predictions regarding the sharing of merger rents and the use of defense tactics.

The outcome in our takeover process might be inefficient. For intermediate economic conditions, the target sets a separating reserve price that is only accepted by the high-type acquirers, despite the fact that all mergers are profitable. Better screening instruments might be available. For example, targets can also allow acquirers to pay in shares of the newly merged firm, giving targets the possibility to offer a menu of prices.[26] A

[26]Brusco et al. [2007] find that an optimal mechanism can be implemented by both merging firms dividing the shares of the new merger-entity. Although this is jointly efficient, however, it is not the best outcome for the target. Therefore, when the target has the possibility to maximize its own expected surplus by setting a reserve price, it should not choose 100% shares as payment.

low-type acquirer would then pay partly in shares while a high-type acquirer would pay fully in cash, giving it the right to 100% of the future earnings. This scheme would allow a target to sell to both types of acquirers, while still capturing some of the extra benefits if the acquirer is of a high type. In Banal-Estañol et al. [2009] we prove formally that under the optimal menu, our main result still holds. In addition, we predict that relatively more share-financed (low-type) mergers occur during booms. We thus provide an alternative logic to misvaluation theories, which explain this stylized fact by arguing that firms use relatively more stock as "acquisition currency" during high merger-activity periods because overvalued acquirers prefer to finance merger deals with stocks.

As most other models of merger waves, our theory is essentially *non-strategic* in the sense that the desirability of a potential merger is unaffected by other takeovers. Our merger wave is induced by an exogenous shift in the economic environment—an upward shift in the market demand—that simultaneously changes all merger conditions and makes screening by targets less desirable. While a dynamic takeover model is beyond the scope of the current paper, *strategic* elements can be included in our setting. For example, if all mergers take place in the same industry, screening may be less important in subsequent mergers. This effect would, for example, arise if high-type acquirers move early so that the probability of facing a high-type acquirer, and therefore the benefit of screening, is lower in later mergers. We leave a full investigation of this question to future research.

Appendix

Proof of Proposition 1

This follows from lengthy but straightforward algebra, which is available on the webpage of the Journal of Industrial Economics. Q.E.D.

Proof of Propositions 2 and 3

The statements are particular cases of Proposition 4, which is shown below. Q.E.D.

Proof of Proposition 4

Denote the net value of the merger to the acquirer as $\hat{\pi}^H(b) \equiv \pi^H(b) - \pi^A(b)$ if she is a high type and as $\hat{\pi}^L(b) \equiv \pi^L(b) - \pi^A(b)$ is she is a low type. The target can set either (i) a reserve price, $r \leq \hat{\pi}^L(b)$; (ii) $r \in (\hat{\pi}^L(b), \hat{\pi}^H(b)]$; or (iii) $r > \hat{\pi}^H(b)$. In case (i), the reserve price is "pooling" r^p; an optimal pooling reserve price is equal to $\hat{\pi}^L(b)$ in the single-bidder case but, since bidders bid their net value for $n \geq 2$, is indeterminant for the multiple-bidder case because any reserve price below $\hat{\pi}^L(b)$ ensures a sale at a price no lower than $\hat{\pi}^L(b)$. Using that bidders bid their net value, the revenue for the target when setting an optimal pooling reserve price is

$$\left[1 - (1-q)^n - n(1-q)^{n-1}q\right] \hat{\pi}^H(b) + \left[(1-q)^n + n(1-q)^{n-1}q\right] \hat{\pi}^L(b).$$

That is, the target obtains the willingness to pay of a low-type acquirer whenever there is at most one high-type acquirer and that of a high-type acquirer otherwise.

We now establish that within case (ii) it is always optimal to set the "separating" reserve price at the upper limit of the interval, $r^s = \hat{\pi}^H(b)$. The target's expected profits are

$$(1-q)^n \pi^T(b) + n(1-q)^{n-1}qr + \left[1 - (1-q)^n - n(1-q)^{n-1}q\right] \hat{\pi}^H(b),$$

which are strictly increasing in r. Finally, in case (iii) where the reserve price is "prohibitive", $r > \hat{\pi}^H(b)$, the target's profits are $\pi^T(b)$ as no bidder is willing to submit a bid.

Clearly, a prohibitive reserve price is suboptimal if and only if a high-type merger is profitable (i.e. $\hat{\pi}^H(b) > \pi^T(b)$ or $\Delta\pi^H(b) > 0$) in which case the target strictly prefers the optimal separating reserve price to a prohibitive one. By Assumption 2, there exists a unique $\underline{b} \in [b_{min}, b_{max}]$ such that $b < \underline{b}$ if and only if $\Delta\pi^H(b) < 0$. Thus for such b a prohibiting reserve price is optimal and, hence, no merger takes place.

Supposing that a high-type merger is profitable ($b > \underline{b}$), the target prefers a separating reserve price r^s to a pooling reserve price r^p whenever

$$\begin{aligned} & \left(1 - (1-q)^n\right) \hat{\pi}^H(b) + (1-q)^n \pi^T(b) \\ \geq \; & \left[1 - (1-q)^n - n(1-q)^{n-1}q\right] \hat{\pi}^H(b) + \left[(1-q)^n + n(1-q)^{n-1}q\right] \hat{\pi}^L(b), \end{aligned}$$

which is equivalent to

$$nq\Delta\pi^H(b) \geq [1-q+nq]\,\Delta\pi^L(b).$$

Hence, a separating reserve price is preferred if (i) $\Delta\pi^L(b) \leq 0$ or if (ii) $\Delta\pi^L(b) > 0$ and

$$\frac{\Delta\pi^H(b)}{\Delta\pi^L(b)} > \frac{1-q+nq}{nq}. \tag{2}$$

If $\Delta\pi^L(b) \leq 0$ for all b then $\overline{b} = b_{\max}$. If, instead, there exists b^* such that $\Delta\pi^L(b^*) > 0$ then, by Assumption 1, for any $b > b^*$, $\Delta\pi^L(b) > 0$. Again, by Assumption 1, there exists a unique $\overline{b} \in [\underline{b}, b_{\max}]$ such that if $\underline{b} < b < \overline{b}$ the target strictly prefers a separating reserve price and if $b > \overline{b}$ the target strictly prefers a pooling reserve price. Q.E.D.

Proof of Corollary 2

It follows from the proof of Proposition 4 that $\underline{b}$ and $\overline{b}(n)$ are implicitly defined through

$$\Delta\pi^H(\underline{b}) = 0 \text{ and } \frac{\Delta\pi^H(\overline{b}(n))}{\Delta\pi^L(\overline{b}(n))} = \frac{1-q+nq}{nq}.$$

Since $(1-q+nq)/nq$ is decreasing in n, Assumption 1 implies that $\overline{b}(n)$ is increasing in n. Q.E.D.

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Figure 1: U.S. Mergers Are Pro-Cyclical, but Merger Abandonments are Counter-Cyclical
(Data-source: SDC Mergers and Acquisitions database of Thomson Financial)