# Why Mergers Reduce Profits and Raise Share Prices – A Theory of Preemptive Mergers*

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**Abstract**

We provide a possible explanation for the empirical puzzle that mergers often reduce profits, but raise share prices. If being an "insider" is better than being an "outsider", firms may merge to preempt their partner merging with a rival. The insiders' stock market value is increased, since the risk of becoming an outsider is eliminated. These results are derived in an endogenous-merger model, predicting the conditions under which mergers occur, when they occur, and how the surplus is shared.

Key Words: mergers; acquisitions; defensive mergers; coalition formation; antitrust.

JEL classification: L13; L41; G34; C78.

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# 1 Introduction

The empirical literature has measured the performance of mergers and acquisitions (M&As), employing two approaches which yield conflicting results. Event studies investigate how the stock market values the merger when it is announced, by comparing the share prices a few weeks before and after the event. Even though there are numerous event studies, their results are consistent. The shareholders of the target firms benefit and those of the bidding firms generally break even. The combined gains are mainly positive.[1] The second strand of the literature compares accounting profits a few years before and after the transaction. A robust result is that mergers lead to a significant reduction in the merging firms' profitability compared to a control sample of firms from various industries. Surveys typically conclude that, on average, mergers are unprofitable.[2] If the empirical evidence is correct, we are left with two puzzles: Why do unprofitable M&As occur? How can the value of firms increase when profits are reduced?

This paper argues that an unprofitable merger may occur if mergers confer strong negative externalities on the firms outside the merger. If becoming an "insider" is better than becoming an "outsider", firms may rationally merge to preempt their partner merging with a rival. Even if a merger reduces the profit flow compared to the initial situation, it may increase this

[1] The early literature was surveyed by Jensen and Ruback (1983), and Jarrell, Brickley and Netter (1988). It contained some debate concerning the effect of merger on the aggregate value of the merging firms. Later contributions more clearly indicate that this effect is positive, see eg Bradley, Desai and Kim (1988), Stulz, Walking and Song (1990), Berkovitch and Narayanan (1993), Huston and Ryngaert (1994), Schwert (1996), and Banerjee and Eckard (1998).

[2] See eg Bild (1998), Caves (1989) and Scherer and Ross (1990). There is also complementary evidence of difficulties associated with mergers. Organization research points at the role of cultural clashes. The human resource management literature indicates that acquired company employees may react unfavorably to M&As. For a survey and synthesis of these literatures, see Larsson and Finkelstein (1999).

flow compared to the relevant alternative – in this case, another merger. In addition, under the hypothesis that the stock market is efficient (in the sense that share prices reflect firms' values), it is shown that share prices and profits may move in opposite directions. In fact, all unprofitable mergers occurring in equilibrium increase the combined stock market value of merging firms. The intuition rests on the fact that the pre-merger value of a firm reflects the risk of this firm becoming an outsider; when the merger is announced, share prices of the merging firms rise due to the new information available, that they will not become outsiders.

The empirical result that mergers reduce profits is obtained in studies using control firms from various industries. When compared to firms from the same industry, the results are mainly insignificant but favor the merging sample. The preemptive merger mechanism also provides a possible explanation for the crucial role of control groups. If the control firms compete with the insiders, they are exposed to externalities from the merger, and the change in relative profitability is a biased measure of the change in the insiders' profitability. With a negative externality, the change in relative profitability over-estimates the merging firms' true change in profitability.

There are several cases illustrating that preemption is sometimes the primary motive behind the acquisition of a rival firm. Northwest Airline acquired 51 percent of the voting rights in Continental Airline, but agreed not to use its voting stake to interfere in the management of Continental for six years; it has only reserved the right to block mergers (The Economist, 1998). Another example is Volvo's attempted acquisition of Scania. Håkan Frisinger, Volvo's chairman of the board, confirmed that the primary motive behind the attempted transaction was to preempt other firms with an interest in Scania (Dagens Nyheter, 1999). Shortly after the merger was blocked by the

European Commission, Volkswagen bought a large minority stake in Scania. It should be emphasized that we do not claim these two mergers to be unprofitable; that we do not know. The two cases only illustrate that strategic motives, and preemption in particular, are important for merger incentives in the real world. Our results show that, in principle, strategic motives may be so strong as to induce firms to agree to unprofitable mergers.

To derive these results and describe the acquisition process, we construct an extensive form model of coalitional bargaining. Firms take turns submitting merger proposals to their competitors, which can either accept or reject them. In the latter case, new proposals can be made in the future. As a consequence, firms endogenously decide whether and when to merge, and how to split the surplus while keeping alternative mergers in mind.

Finally, we want to emphasize a caveat. The paper provides a taxonomy of different mergers and shows that, depending on the circumstances, three types of mergers may occur in equilibrium. We have already discussed the first type. The second type of merger is profitable, and it is more profitable to be an insider than an outsider. Also in this case is there a merger race, and the aggregate stock market value of the merging firms is increased. The third type of merger is also profitable, but it is even more profitable to stand as an outsider. In this case, there is a war of attrition − firms wait to bid, hoping that their competitors will instead merge − and the merging firms' stock market value is unaffected by the merger. We have chosen to focus on unprofitable mergers only, since it is this type of merger that may enhance our understanding of the empirical puzzles on merger performance. However, we do not wish to conclude that all mergers are of this type. In fact, the empirical literature suggests mergers to be unprofitable on average, but that there is considerable variation, with some mergers being successful.

For the model to mimic the empirical distribution, a distribution of different mergers, some profitable and some unprofitable, may be considered. All equilibrium mergers either increase or leave the combined stockmarket value of the merging firms unchanged.

Before presenting and solving the model in sections 3 and 4, the next section discusses related literature. Section 5 demonstrates why mergers may reduce profits and raise share prices. Section 6 shows why control groups are of importance in profit studies. Implications for future empirical work are spelled out in the Concluding Remarks.

# 2 Related Literature

This paper contributes to the literature explaining why unprofitable mergers may occur. Previous contributions include Roll (1986) who argues that those managers overestimating their ability (or profit opportunities in general) the most, are also most likely to buy a target firm. Shleifer and Vishny (1988) argue that managers have other motives than value maximization, such as the size of their organization, while Fauli-Oller and Motta (1996) argue that unprofitable mergers arise as a side effect of strategic delegation. All these hypotheses may contribute to a full understanding of why unprofitable mergers occur.

We also contribute to the literature on preemption as a motive for mergers. Horn and Persson (2001b) question the validity of the so-called tariff-jumping argument, according to which international mergers are more likely than domestic ones, since they save on trade costs. Using a cooperative game theory model, they show that domestic firms may agree to (a profitable) merger to preempt international mergers that would stiffen the competition

in the home market. Brito (2003) argues that under spatial competition, some outsiders gain more than the participating firms, but that others might benefit less. As a result, firms may decide to merge to preempt rival mergers. In relation to these papers, our contribution is to show that preemption may even lead to unprofitable mergers. Before us, Nilssen and Sorgard (1998) show that preemption may induce firms to agree to an unprofitable merger. The main difference of their work is that they discuss the preemptive merger motive in a setting where the preemptive and preempted mergers are between two *disjoint* sets of firms. As the business press contains numerous examples of firms racing to acquire the same targets, our extension seems well motivated. In fact, it is the uncertainty about the outcome in such races that may explain why insiders' value increases even though their profits are reduced.[3]

The paper also contributes to the literature on the equilibrium foundations of event study methodology. Since mergers are adaptations to observable changes in market conditions, they may be anticipated.[4] Typically, however, some uncertainty remains about if and when a merger will occur and therefore, the merger announcement carries information. The literature on conditional event studies shows how to extract this information, explicitly dealing with anticipations (Acharya, 1988 and 1993; Eckbo, Maksimovic and Williams, 1990; Prabhala, 1997). Essentially, when mergers are anticipated, changes in stock market values under-estimate changes in profits. Such a

[3]Our work is also related to the literature on auctions of assets causing externalities on other potential buyers; negative externalities may induce a buyer to increase its bid above its valuation to preempt a rival bidder from acquiring the asset. For applications to (profitable) mergers, see eg Funk (1996), Jehiel and Moldovanu (1996), and Persson (2004).

[4]Mitchell and Mulherin (1996) and Jovanovic and Rousseau (2001) provide evidence of mergers indeed being adaptations to changing market conditions. Bradley, Desai and Kim (1983) find evidence of pre-merger share prices incorporating expectations of mergers.

bias towards zero may not be a crucial problem, however, since our interest primarily lies in the sign of the change. Our contribution to this literature is to point out that even if a merger is anticipated, the stock market may be uncertain about insiders' identity. It is this uncertainty that may cause merging firms' value and profits to move in opposite directions.

There may also be other explanations for why share prices may increase when profits are reduced. Rau and Vermaelen (1998) show that a large number of merged firms under-perform on the stock market in the long run, and that this is more likely in case the buyer has a low book-to-market value before the merger. Their findings suggest that both the market and the management over-extrapolates the past performance of successful managers. Although Rau and Vermaelen never relate their work to the evidence from accounting profit studies, their results suggest a complementary explanation to the two puzzles discussed in our paper; hubris may lead to unprofitable mergers and mis-pricing in non-efficient stock markets may cause the firms' values to increase.[5]

From a methodological point of view, we also contribute to the literature on endogenous mergers (ie the use of coalition formation theory to study mergers). Cooperative approaches have been investigated by Deneckere and Davidson (1985b) and Horn and Persson (2001a, 2001b). Kamien and Zang (1990, 1991 and 1993) proposed the first fully non-cooperative model, describing merger negotiations as a so-called Nash demand game. Gowrisankaran (1999) considers a variant of this model with a predetermined order of moves. In Fridolfsson and Stennek (2004a), we propose a non-cooperative bargaining

[5]Yet an alternative explanation would be that the apparent inconsistency of the two literatures results from different studies including different mergers in their samples. This explanation is unlikely, however, since each method has been used repeatedly and found to yield relatively consistent results.

model à la Rubinstein-Ståhl, and in the present paper, we extend this model by formally including an exogenous shock to trigger a merger.[6]

# 3 The Model

Consider an industry with three identical firms, each earning a continuous-time profit flow, denoted $\pi_s$, where $s$ indicates the state of the market, eg the level of demand or the cost of production. If they so wish, any two firms may merge and turn the market into a duopoly. The merged and the outsider firms earn profit flows $\pi_s^+$ and $\pi_s^-$, respectively. To simplify the analysis, we assume mergers to monopoly to be illegal, however.[7] These profit flows are derived in an explicit oligopoly model below.[8]

Mergers are typically triggered by changes in industry-wide market conditions, such as deregulation, factor price changes, foreign competition and technological innovations (Mitchell and Mulherin, 1996; Jovanovic and Rousseau, 2001). To model the trigger in a simple way, we assume that the market is hit by a single industry-wide shock, eg an increase in demand, moving the industry from state $y$ to state $z$. The shock occurs at a random point in time, but is anticipated by all agents. The probability that a shock has occurred by time $t$ is described by the cumulative distribution function $F(t) = 1 - e^{-\lambda t}$, with the constant hazard rate $f(t) / (1 - F(t)) = \lambda \in (0, \infty)$, where $f(t)$ denotes the probability density function.

[6] Surprisingly little work has been devoted to analyzing how changes in market conditions may trigger mergers. For exceptions, see Dutz (1989), Gowrisankaran (1998) and Fauli-Oller (2000).

[7] The rationale may be that mergers to duopoly generate sufficient cost synergies to reduce consumer prices, but that mergers to monopoly are anti-competitive. For an extension of the model to allow for mergers to monopoly, see Fridolfsson and Stennek (2004a).

[8] To fix ideas, we assume that firms do not collude in the product market. This would, for instance, be the case if the discount factor were sufficiently small or if there were efficient antitrust enforcement.

**A Taxonomy of Mergers** Our analysis shows how merger incentives depend on the profits in the different market structures and expected future changes in these profits due to the shock. To simplify our presentation, we construct a taxonomy of mergers based on the effects of mergers on profits. Figure 1 describes all possible profit configurations in a given state $s$. According to the exogenous merger literature,[9] a merger may be profitable, in the sense that $\pi_s^+ > 2\pi_s$, eg due to increased market power or efficiency gains. In Figure 1, this possibility is illustrated as the area above the line $\pi_s^+ = 2\pi_s$. However, a merger may also be unprofitable if, for example, the outsider substantially expands its production in response to the merger, the new organization is more complex to manage or there are substantial costs of restructuring. In Figure 1, this possibility is illustrated as the area below the line $\pi_s^+ = 2\pi_s$. Normally, a merger also confers an externality on the outsider. Since a merger reduces the number of competitors, there is a positive market power effect so that $\pi_s^- > 2\pi_s$. In Figure 1, this possibility is illustrated as the area on the right-hand side of $\pi_s$ on the x-axis. However, if the merging parties can substantially reduce their marginal costs, they become a more difficult competitor, which may harm outsiders, so that $\pi_s^- < 2\pi_s$.[10] In Figure 1, this possibility is illustrated as the area on the left-hand side of

[9] This literature studies whether an exogenously selected group of firms (insiders) would increase their profit by merging compared to the situation in an unchanged market structure. Depending on the details of the situation, the insiders (and outsiders) would or would not profit from a merger, see Szidarovszky and Yakowitz (1982), Salant, Switzer and Reynolds (1983), Deneckere and Davidson (1985), Perry and Porter (1985), Levy and Reitzes (1992), Reitzes and Levy (1995), Boyer (1992) and Lommerud, Straume and Sörgard (2000).

[10] In a homogenous goods oligopoly, marginal cost savings must be substantial for a merger to reduce the price and harm competitors (Farrell and Shapiro, 1990). With spatially differentiated products, on the other hand, synergies are not required for a merger to hurt competitors (Boyer, 1992). Note also that competitors may be hurt at the same time as consumer prices are increased. One example is if the outsider is induced to exit. Another example is provided by Boyer.

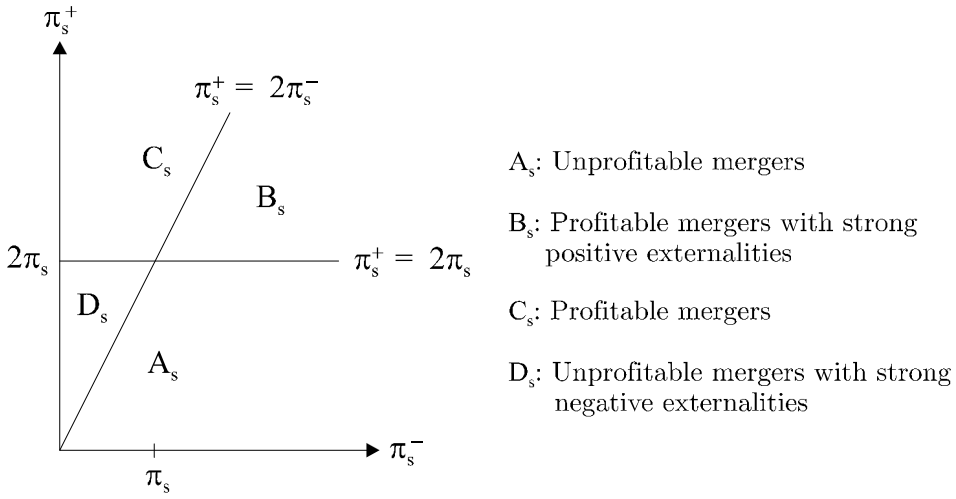


Figure 1: A taxonomy of different mergers.

$\pi_s$ on the x-axis. Furthermore, the externality may be strong in the sense of the effect on profits being larger for the outsider than for the insiders, ie $|\pi_s^- - \pi_s| > |\pi_s^+/2 - \pi_s|$. Area $D_s$ represents markets where a merger is unprofitable, and even more unprofitable to the outsider. Area $B_s$ represents markets where a merger is profitable, but even more so to the outsider. In the following analysis, we show that the incentives to merge differ a great deal, depending on whether a market is described by a point in area $A_s$, $B_s$, $C_s$ or $D_s$.

A simple oligopoly model illustrates this taxonomy. Consider a linear homogenous good Cournot triopoly where inverse demand is given by $p = \alpha_s - \beta_s Q$. Before merger, the common constant marginal cost is $c_s < \alpha_s$. The equilibrium triopoly profits are given by $\pi_s = (\alpha_s - c_s)^2 / 16\beta_s \equiv M_s^2/\beta_s$. If two firms merge and restructure production, they reduce the marginal cost by $d_s < 4M_s$ and incur a fixed cost $f_s$. The marginal cost reduction captures scale economies, eg due to increased specialization or mechanization, and

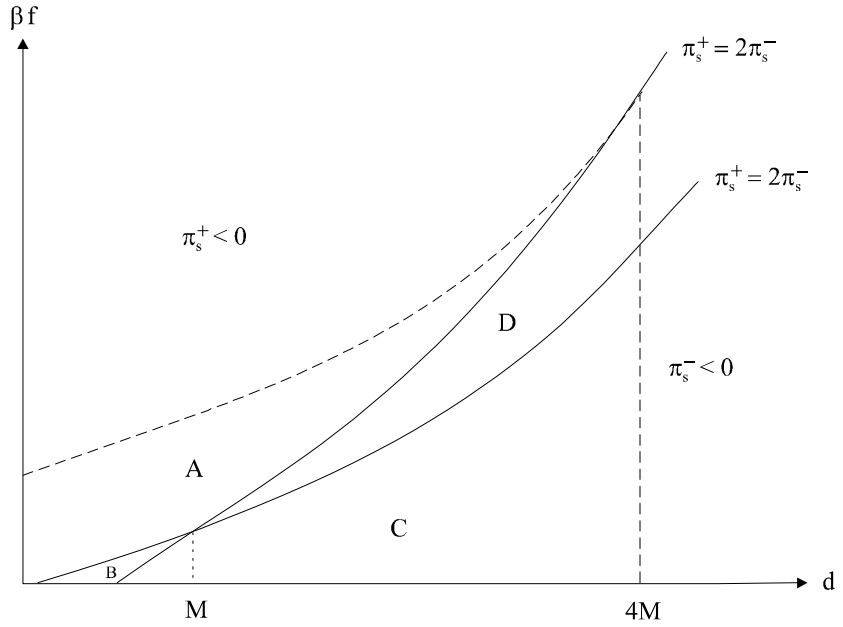


Figure 2: A Cournot example.

the increased fixed cost captures investments in machinery, increased costs of control and coordination and annuity payments of the one-time cost of restructuring. The equilibrium profits of the insider and the outsider are given by $\pi_s^+ = (4M_s + 2d_s)^2/9\beta_s - f_s$ and $\pi_s^- = (4M_s - d_s)^2/9\beta_s$, respectively. To derive the taxonomy, note that the merger is profitable $[\pi_s^+ > 2\pi_s]$ iff $\beta_s f_s < (4M_s + 2d_s)^2/9 - 2M_s^2$, that it has a positive externality $[\pi_s^- > \pi_s]$ iff $d_s < M_s$ and that it is better to be an insider than an outsider $[\pi_s^+/2 > \pi_s^-]$ iff $\beta_s f_s < 2(16M_s d_s - 8M_s^2 + d_s^2)/9$. These conditions are displayed in Figure 2 in the $(d, \beta f)$ plane, with $M$ being a shift-parameter for all curves. The different regions are given the same labels as in Figure 1.

While the theoretical literature has extensively studied the effects of mergers on profits, taking market conditions as given, surprisingly little work has been devoted to analyzing how changes in market conditions may trigger

mergers. Figure 2 illustrates how a change in the exogenous market conditions, eg in the size of merger induced synergies, the cost of restructuring, the level of demand or the cost of production, may move the market from one region to another. For example, an increase in demand, represented by a reduced $\beta$, may move the market from region $A$, where mergers are unprofitable both in absolute and relative terms, to region $D$, where a merger is still unprofitable but where being an insider is better than being an outsider. In the following analysis, we show how mergers may be triggered by such changes.

**The Acquisition Game** In the spirit of Rubinstein-Ståhl bargaining, the acquisition process is modeled as a multi-stage (three-person) bargaining game with an infinite horizon. The bidding rounds occur at random points in time. In each round, a randomly selected firm is given the opportunity to submit a bid for some other firm, and the target can either accept or reject the bid. The proposal and the reply are assumed to take no time. Once a merger from triopoly to duopoly occurs, the bargaining ends. At any time $t$, the probability of the next bidding round having occurred by time $t+\Delta$, is described by the cumulative distribution function $G(\Delta) = 1 - e^{-\mu\Delta}$, with the constant hazard rate $g(\Delta)/(1-G(\Delta)) = \mu \in (0,\infty)$. Thus, at any time, the expected time until the next bidding round is given by $\int_0^\infty \Delta g(\Delta)\, d\Delta = 1/\mu$. We interpret $\mu$ as a measure of the speed of decision-making in the firms, eg how quickly they react to a shock.

A strategy describes a firm's behavior in the multi-stage bargaining game: whether and how much to bid, and a reservation price at which to accept offers. We restrict the attention to symmetric Markov perfect equilibria, which implies that strategies only depend on the current state. Such an

equilibrium is characterized by a triplet $(p_s, b_s, a_s)$ for each state $s \in \{y, z\}$, where $p_s \in [0, 1/2]$ denotes the probability of a firm bidding for one specific firm in any bidding round in state $s$, $b_s$ denotes the size of this bid, and $a_s$ the lowest bid a target firm will accept.

Firms are assumed to maximize their stock market values. Let $W_s$ denote the value of a triopoly firm in state $s$, and $W_s^+$ and $W_s^-$ the values of the merged firm and the outsider, respectively. These values are computed below. The equilibrium in the acquisition game is described by three conditions for each state. First, by subgame perfection, an offer is accepted iff the bid is at least as high as the value of the firm. Second, a bidder does not offer more. Hence, $b_s = a_s = W_s$. Third, a firm bids iff bidding maximizes its value. If the firm does not bid, its value is $W_s$, if it bids, the value is $W_s^+ - b_s$. Hence, in equilibrium,

$$\begin{cases} p_s = 0 & \text{and} \quad W_s^+ - b_s \leq W_s \quad \text{or} \\ p_s = 1/2 & \text{and} \quad W_s^+ - b_s \geq W_s \quad \text{or} \\ p_s \in (0, 1/2) & \text{and} \quad W_s^+ - b_s = W_s. \end{cases} \tag{1}$$

We say that there is a no-merger equilibrium in state $s$ if $p_s = 0$, a merger-race equilibrium if $p_s = 1/2$ and a merger-holdup equilibrium if $p_s \in (0, 1/2)$.

**The Stock Market** To model the stock market equilibrium, we assume the stock market to be efficient − the stock market value of a firm equals the expected discounted sum of future profits (which are continuously distributed as dividends). Moreover, the stock market is assumed to have the same information as the firms, ie it anticipates the shock and predicts the equilibrium both in the oligopoly and the acquisition games.

If a merger occurs in state $z$, the equilibrium stock market values of the

merged firm (+) and the outsider firm (-) are given by

$$W_z^i = \int_0^\infty \pi_z^i e^{-r\tau} d\tau = \pi_z^i / r, \tag{2}$$

for $i \in \{+, -\}$, where $r$ is the interest rate. If a merger to duopoly occurs in state $y$, the equilibrium stock market values of the firms in the duopoly are given by

$$\begin{aligned} W_y^i &= \int_0^\infty \left( \int_0^t \pi_y \left(2^i\right) e^{-r\tau} d\tau + \int_t^\infty \pi_z \left(2^i\right) e^{-r\tau} d\tau \right) f(t)\, dt \\ &= \tfrac{r}{r+\lambda} \pi_y^i / r + \tfrac{\lambda}{r+\lambda} \pi_z^i / r, \end{aligned} \tag{3}$$

for $i \in \{+, -\}$, which is a weighted average of the profit flows before and after the shock.

To simplify the definition of the stock market value of a triopoly firm in state $s$, we first define the firm's value at the time of a bidding round, before the bidder's identity is revealed, as

$$V_s = \tfrac{2}{3} p_s \left(W_s^+ - b_s\right) + \tfrac{2}{3} p_s b_s + \tfrac{2}{3} p_s W_s^- + \left(1 - 2p_s\right) W_s. \tag{4}$$

The values of becoming a buyer $(W_s^+ - b_s)$, seller $(b_s)$, outsider $(W_s^-)$ and remaining a triopolist $(W_s)$ are simply multiplied by the corresponding probabilities. For example, the probability of becoming a buyer is $(2p_s)/3$, since a firm is selected to bid with probability $1/3$, and it bids for each of the other two firms with probability $p_s$. The stock market value of a triopoly firm in

state $z$ is then given by

$$\begin{aligned} W_z &= \int_0^\infty \left[\left(1-e^{-r\Delta}\right)\pi_z/r + e^{-r\Delta}V_z\right] g\left(\Delta\right) d\Delta \\ &= \tfrac{r}{r+\mu}\pi_z/r + \tfrac{\mu}{r+\mu}V_z. \end{aligned} \tag{5}$$

The first term corresponds to the discounted profits until the next bidding round, and $V_z$ is the value of the firm at a bidding round before the the bidder's identity is revealed. Since the length of time until the next bidding round, ie $\Delta$, is random, the expected value of a triopoly firm is obtained by integrating over $\Delta$. Similarly, the stock market value of a triopoly firm in state $y$ is given by

$$\begin{aligned} W_y &= \int_0^\infty \left\{ F\left(\Delta\right)\left[\int_0^\Delta \left(\int_0^t \pi_y e^{-r\tau}d\tau + \int_t^\Delta \pi_z e^{-r\tau}d\tau\right)\tfrac{f(t)}{F(\Delta)}dt + e^{-r\Delta}V_z\right] \right. \\ &\qquad \left. + \left(1-F\left(\Delta\right)\right)\left[\int_0^\Delta \pi_y e^{-r\tau}d\tau + e^{-r\Delta}V_y\right]\right\} g\left(\Delta\right) d\Delta \\ &= \tfrac{\lambda}{\lambda+r+\mu}\left(\tfrac{r}{r+\mu}\pi_z/r + \tfrac{\mu}{r+\mu}V_z\right) + \tfrac{r+\mu}{\lambda+r+\mu}\left(\tfrac{r}{r+\mu}\pi_y/r + \tfrac{\mu}{r+\mu}V_y\right), \end{aligned} \tag{6}$$

where $F\left(\Delta\right)$ is the probability of a shock having occurred before the next bidding round. $W_y$ is a weighted average of profit flows before and after the shock, taking into account that there may be a merger in any state.

# 4 The Equilibrium

Our main focus is to delineate the conditions under which there exists an equilibrium where (i) firms do not merge prior to the shock, and (ii) there is a merger race subsequent to the shock. As it turns out, this is the type of situation that yields predictions replicating the stylized facts from the empir-

ical literature. Working backwards, our analysis starts with the equilibrium in case the triopoly remains after the shock.

**Equilibrium subsequent to shock** To understand the logic behind merger race equilibria, first note that it is optimal for the firms to bid with certainty $[p_z = 1/2]$ iff the expected value of bidding exceeds the expected value of not bidding, ie $W_z^+ \geq 2W_z$. Second, when $p_z = 1/2$, the stock market value of a triopoly firm is $W_z = \frac{r}{r+\mu}\pi_z/r + \frac{\mu}{r+\mu}\frac{1}{3}\left(W_z^+ + W_z^-\right)$, giving some weight to the pre-merger profit level, but also some weight to the post-merger profit level that will be realized when one of the firms buys one of its competitors on the next bidding occasion. Since the post-merger profits are given by $W_z^i = \pi_z^i/r$, there exists a merger-race equilibrium iff

$$\frac{r}{r+\mu}\left(\pi_z^+/2 - \pi_z\right) + \frac{\mu}{r+\mu}\left(\pi_z^+/2 - \pi_z^-\right)/3 \geq 0. \tag{7}$$

This condition reveals two different motives for mergers. The first term indicates that firms will have an incentive to bid for a competitor if the merger is profitable. The second term indicates that the firms will have an incentive to bid if it is better to be an insider than an outsider – a preemption motive. This preemption motive is especially strong when firms expect their rivals to bid in the near future. In the limit, when firms are infinitely quick $[\mu \to \infty]$, only the preemptive motive is of importance.

Further analysis reveals that there exists an equilibrium for all points in the parameter space, but also the presence of multiple equilibria. The complete equilibrium structure for state $z$ is presented and formally proved in Lemma 1 of Appendix A. In the special case when firms are infinitely quick $[\mu \to \infty]$, Figure 1 illustrates the parameter configurations under which the different types of equilibria exist. As already argued, there exists a merger-

race equilibrium iff being an insider is better than being an outsider [$\pi_z^+/2 \geq \pi_z^-$]; such an equilibrium exists in areas $C_z$ and $D_z$ of Figure 1. There exists a no-merger equilibrium iff the merger is unprofitable [$\pi_z^+ \leq 2\pi_z$], illustrated as areas $A_z$ and $D_z$. There exists a holdup equilibrium iff mergers are profitable but being an outsider is even more profitable [$\pi_z^- > \pi_z^+/2 > \pi_z$], illustrated as area $B_z$, or mergers are unprofitable but being an outsider is even more unprofitable [$\pi_z^- < \pi_z^+/2 < \pi_z$], illustrated as area $D_z$. (For the case when the firms are not infinitely quick, the only difference is that the diagonal line is rotated clock-wise around the intersection with the horizontal line, and approaching the horizontal line as $\mu \to 0$.) Thus, whenever unprofitable mergers may occur in equilibrium (area $D_z$ in figure 1), also a no-merger (as well as a holdup) equilibrium exists. Our explanation of the stylized facts thus hinges on an equilibrium selection.[11]

**Equilibrium prior to shock** The equilibrium structure in $y$ is more complex than the equilibrium structure in $z$, since merger incentives in $y$ also depend on the profit levels and merger incentives after the shock. We will focus on the case when there is a no-merger equilibrium in $y$, given that there is a merger-race equilibrium in $z$. Then, as shown in Lemma 2 (in Appendix A), a necessary condition for firms not to bid before the shock is that mergers are unprofitable prior to the shock, ie

$$\pi_y^+ \leq 2\pi_y. \tag{8}$$

[11] Risk-dominance arguments à la Harsanyi and Selten (1988) point at the selection of the merger-race equilibrium (see Fridolfsson and Stennek, 2000). Moreover, if firms are asymmetric and one merger is profitable while the other two are unprofitable, the merger-race equilibrium may be unique (Fridolfsson, 2001). Since one merger is profitable, a no-merger equilibrium does not exist. Moreover, in the merger-race equilibrium, unprofitable mergers occur with strictly positive (sometimes high) probability. Intuitively, if the negative externality from the profitable merger is large, some firms have an incentive to preempt this merger.

Given (8), there exists a no-merger equilibrium in $y$ iff

$$\lambda \leq \lambda_{NoMerger}, \tag{9}$$

where $\lambda_{NoMerger}$ is defined in the Lemma. To understand the second condition, note that the decision problem faced by the firms is related to the problem of optimal investment timing and real options (see Dixit, 1992). On the one hand, since mergers are unprofitable in $y$, there is a value of waiting to acquire another firm. On the other hand, waiting entails a risk of becoming an outsider. When the expected waiting time until the shock is sufficiently long (ie $\lambda$ is small), firms put a large weight on the immediate cost of merging and a small weight on the future gain.[12]

# 5 The Preemptive Merger Hypothesis

**Unprofitable Mergers** The condition for a merger race to arise after the shock is not that mergers are profitable. As revealed by condition 7, there is also a preemption motive for mergers; if one firm has an incentive to merge, then (in our symmetric setting) so do the other firms. Thus, the relevant alternative to a merger is not status quo, but another merger. As a direct consequence of Lemma 1:

**Proposition 1** *Unprofitable mergers may occur in equilibrium, if being an outsider is even more disadvantageous.*

The incentives for such preemptive mergers can arise as a consequence of two of the most important forces determining market concentration, namely

[12]This equilibrium is unique if also $\lambda < \lambda_{Race} < \lambda_{NoMerger}$. Further characterizations of the equilibrium structure is found in Fridolfsson and Stennek, (2004b).

technologically determined economies of scale and scope, and diseconomies related to information problems in large organizations. As a result of these forces, horizontal integration often saves on variable costs at the same time as fixed costs are increased.[13] [14] In most industries, the optimal market concentration from the firms' point of view is probably at some intermediate level. It is not a competitive market (too high variable costs), but it is not a monopoly either (too high fixed costs). Increased concentration may thus benefit the firms, as well as society as a whole, up to a certain point. What is shown by Proposition 1 is that due to the negative externality associated with the reduced marginal cost, concentration may go beyond the level which is optimal even from the firms' point of view.

There is, however, a potential objection to the idea of preemptive mergers, suggested by the Northwest-Continental case mentioned in the Introduction. Northwest continues to operate the firms under separate management. In this way, the firm protects itself against becoming an outsider and avoids the costly process of merging different organizations and types of airplanes. A virtual merger (buying a competitor without integrating the firms) is not always an option, however. Once the competitor has been bought, the buyer

[13] Chandler (1990) provides an extensive historical account of how variable costs have been reduced at the expense of increased fixed costs. Direct labor costs have been reduced by means of mechanization and specialization, requiring investments in industrial machinery and the building of coordinating hierarchies. In addition, the literature on the theory of the firm indicates that hierarchies themselves are characterized by decreasing returns as a result of computational burden (Radner, 1992), incentive problems such as moral hazard (Jensen and Meckling, 1976) and influence activities. To the fixed costs, one should also add the one-time costs of arranging the merger, which can be substantial, eg due to problems of fusing different company cultures. For instance, the cost of the merger between Pharmacia and Upjohn was estimated to 1.6 billion dollars for the period 1995-97, as a contrast to the equity value of 5.5 billion dollars (Affärsvärlden, 1998).

[14] These two forces are also captured by the oligopoly model of section 3. The marginal cost reduction (denoted $d$) captures scale economies, and the increased fixed cost (denoted $f$) captures investments in machinery, increased costs of control and coordination and annuity payments of the one-time cost of restructuring.

may, in fact, have an incentive to integrate the firms. To see this, first note that an owner's decision to delegate management need not be credible. The owner certainly wants to internalize price and output decisions among his firms. This is also understood by the competitors. Hence, joint ownership may entail joint price and output decisions. Second, once the price and quantity decisions are coordinated, the owner may also want to integrate the production processes. For example, attaining variable cost synergies at the expense of increased fixed costs, may be a strategically profitable "top dog" strategy.[15]

Finally, preemptive mergers may also occur in markets with more than three firms. Two additional complexities arise, however, namely asymmetries and intertemporal links between mergers. Consider a market with four identical firms and the possibility of a merger, first to triopoly, and then to duopoly. (Mergers to monopoly are forbidden.) Subsequent to the first merger to triopoly, the firms are asymmetric with one firm having two units of capital. Still, an unprofitable merger from triopoly to duopoly may occur if becoming an outsider is even worse (see Fridolfsson, 2001). Also in the quadropoly (prior to the first merger), the firms may attempt to acquire one another for preemptive reasons. However, a quadropoly firm's incentive to become an insider depends on the likelihood of the merged (and thus large) firm also becoming an insider in the second merger. (For an extension of our model to sequential mergers, see Fridolfsson and Stennek, 2004.)[16]

[15] Such an example naturally arises in the oligopoly model of section 3. If the merged firm does not integrate its plants [$f = d = 0$], its profits are $\tilde{\pi}_s^+ = 16M_s^2/9\beta_s$. Integration is thus profitable [$\pi_s^+ > \tilde{\pi}_s^+$] if $\beta_s f < (4M_s + 2d_s)^2/9 - 16M_s^2/9$. This condition is fulfilled at the same time as the merger is unprofitable [$\pi_s^+ < 2\pi_s$] and as being an insider is better than being an outsider [$\pi_s^+/2 > \pi_s^-$] if $M_s = \beta_s = 1$, $d_s = 2$ and $f_s = 5.2$.

[16] A preemptive merger from quadropoly to triopoly may also occur in case no subsequent merger takes place. Such a merger pattern is reminiscent of Nilssen and Sorgard (1998) – a first merger removes the incentives for a subsequent merger between the outsiders to

**Increased Share-Prices** Next, we study the evolution of insiders' stock market value, assuming there **to be** a merger race after the shock (inequality 7), and that firms do not bid prior to the shock (inequalities 8 and 9). Working backwards, the value (per capital unit) of the merged firm subsequent to the merger is given by

$$W_z^+/2 = \pi_z^+/2r. \tag{10}$$

In the intermediate period between the shock and the merger, the stock market value of a future insider is given by

$$W_z = \tfrac{r}{r+\mu}\pi_z/r + \tfrac{\mu}{r+\mu}\left(\pi_z^+ + \pi_z^-\right)/3r, \tag{11}$$

as shown in Lemma 1. Note that $W_z$ gives some weight to the pre-merger profit level, $\pi_z$. Since a merger is anticipated and since each firm becomes an acquirer, target or outsider with equal probability, $W_z$ also gives some weight to the average post-merger profit level in the market, $\left(\pi_z^+ + \pi_z^-\right)/3$. These weights are determined by the speed of the merger process, $\mu$. Prior to the shock, the stock market value of a future insider is given by

$$W_y = \tfrac{r}{\lambda+r}\pi_y/r + \tfrac{\lambda}{\lambda+r}\left(\tfrac{r}{r+\mu}\pi_z/r + \tfrac{\mu}{r+\mu}\left(\pi_z^+ + \pi_z^-\right)/3r\right), \tag{12}$$

as shown in Lemma 2. Note that $W_y$ gives some weight to the profit level prior to the shock, $\pi_y$, but also to the profit levels subsequent to the shock, taking into account merger anticipations. These weights are determined by the likelihood of the shock, $\lambda$. A possible pattern for the evolution of the stock market value is depicted in Figure 3.

The change in the insiders' combined value at the time of the merger is

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the first merger.

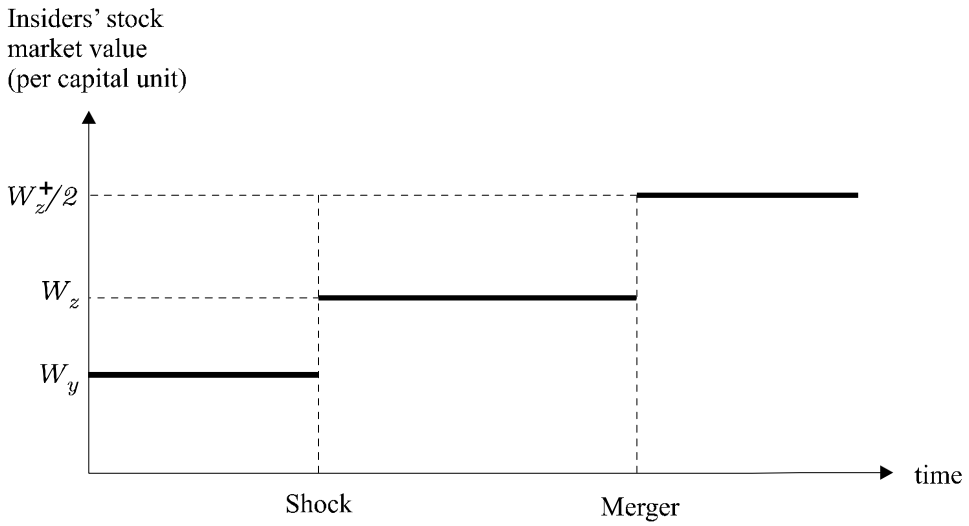


Figure 3: The evolution of the merging firms' stock market value.

thus given by

$$W_z^+/2 - W_z = \frac{r}{r+\mu}\left(\pi_z^+/2 - \pi_z\right)/r + \frac{\mu}{r+\mu}\left(\pi_z^+/2 - \pi_z^-\right)/3r, \tag{13}$$

which is a convex combination of a negative term capturing the reduction in profits and a positive term capturing the fact that the insiders won the merger race. In equilibrium, the positive term always dominates the negative one. This fact immediately follows from equilibrium condition (1) that all mergers occurring in equilibrium at least weakly increase the combined value of the merging firms $[W_z^+ \geq 2W_z]$.[17] Hence:

**Proposition 2** *Unprofitable mergers occurring in equilibrium increase the combined stock market value of the merging firms.*

Intuitively, the pre-merger value of each merging firm is low, since it reflects the risk of the firm becoming an outsider. As an immediate consequence,

[17] The increase in value is generically strictly positive when there is a merger race.

rising share prices should not be taken as proof of a merger creating value, since share prices and profits may move in opposite directions. Moreover, Proposition 2 demonstrates that the empirical studies based on share prices and profit flows may be consistent.

The preemptive merger hypothesis also has a residual implication, namely that the outsider's value decreases, ie $W_z^- < W_z$. The available evidence on this point is not fully conclusive, however. Stillman (1983) finds no statistically significant effect on the outsiders' share prices, while Eckbo (1983) finds a statistically significant increase. The latter study, however, is also inconclusive; in those cases where the competition authorities announce an investigation of the merger, there is no significant effect on outsiders' share prices. Schumann (1993) confirms this pattern. In contrast, Banerjee and Eckard (1998) show that during the Great Merger Wave of 1897 - 1903, the competitors suffered significant value losses.[18] Similarly, Bradley, Desai and Kim (1983) find significant value losses for outsiders in a sample of mergers from 1963 to 1980.[19]

Proposition 2 crucially hinges on the assumption that the stock market is efficient and, in particular, that it anticipates future mergers. Assume that the stock market does not understand the equilibrium of the merger

[18] Banerjee and Eckard also report small drifts in the share prices for two months before the merger event. The insiders' values are increased (although economically insignificantly). The outsiders' values are reduced (although statistically insignificantly). These movements are consistent with the preemptive merger cum anticipation hypothesis if the stock market already expects an unprofitable merger, and if it is membership information that is leaking in the last two months.

[19] The event-study literature also shows that targets on average capture the whole stock market surplus from mergers. The prediction of our model is at odds with this evidence, since the target receives its reservation value only. In Fridolfsson and Stennek (2001), however, we consider an alternative specification of our model where two firms may simultaneously submit competing bids for the same target. In this case, a Bertrand-like competition for the target arises in merger-race equilibria and, as a result, the target takes the whole stock market surplus from the merger.

formation game, and does not foresee an upcoming merger; rather it expects the triopoly to remain forever. The pre-merger value of the firms is then given by $\widetilde{W}_z = \pi_z/r$. Consequently, the evolution of the stock market value of the merging firms, from $2\widetilde{W}_z$ to $W_z^+ = \pi_z^+/r$ does reflect the profitability of the merger. Hence, in order to correctly interpret event study evidence, it is important to empirically discriminate between the efficient market (anticipation) hypothesis and the surprise hypothesis. Interestingly, Bradley, Desai and Kim (1983) analyze share price data between initially unsuccessful merger attempts and later successful mergers in order to detect expectations about future mergers. Their evidence suggests pre-merger share prices to reflect expectations of successful future mergers for long periods of time prior to their announcements. This evidence is thus consistent with the anticipation hypothesis, while it rejects the surprise hypothesis.

So far, we have only discussed the change in value at the point in time when a merger is announced. In practice, the changes are measured over short periods of time around the announcements. Then, the shock will be included in the event window with positive probability.[20] The measured change will then be given by $W_z^+/2 - W_y$, also capturing a trigger effect, $\pi_z - \pi_y$. The implied identification problem is probably not important, however; since event studies typically use short windows, they are unlikely to include the trigger effect. In contrast, identification may be a severe problem in profit studies, as argued in the next section.

[20] This possibility is formally analyzed in Fridolfsson and Stennek (2004b).

# 6 On the Construction of Control Groups in Profit Studies

The empirical evidence suggests most M&A activity to be due to changes in industry-wide market conditions, examples of which are deregulation, factor price changes, foreign competition and technological innovations (Mitchell and Mulherin, 1996; Jovanovic and Rousseau, 2001). Since accounting profit studies must be extended for several years around the transaction, they are likely to include the event triggering the merger. To control for shocks, all modern studies measure the change in the insiders' profits in relation to the change in the profits of a control sample. The literature can be divided into two parts. Some studies (e.g. Meeks, 1977; Ravenscraft and Scherer, 1987) use control samples consisting of firms from various industries, henceforth referred to as inter-industry control groups. Other studies (e.g. Healy, Palepu and Ruback, 1992) use firms from the same industry as the merging firms, henceforth referred to as intra-industry control groups. As it turns out, the results are sensitive to the choice of control group. Merging firms perform significantly worse than inter-industry control groups, but when compared to firms from the same industry, the effect of mergers is mainly insignificant, and in those cases where it is significant, the results favor the merging sample.[21]

The importance of control groups may be understood in terms of our model. Consider a merger taking place at time 0, and assume pre- and post-merger profits to be measured during periods $(\tau, 0)$ and $(0, t)$, and the shock triggering the merger to occur at time $s \in (\tau, 0)$. The measured change in the merging firms' profits (per capital unit) is then given by $\Delta\pi^+ =$

[21] See Bild (1998) for details.

$(\pi_z^+/2 - \pi_z) + \rho(\pi_z - \pi_y)$ where $\rho \equiv \left(1 - e^{-r(s-\tau)}\right)/\left(1 - e^{r\tau}\right) \in (0,1)$.[22] The question is whether the use of a control group can eliminate the trigger effect, $\pi_z - \pi_y$, in order to identify the profit effect $\pi_z^+/2 - \pi_z$. Let $\tilde{\pi}_y$ denote the profits of a (representative) control firm before the shock, $\tilde{\pi}_z$ its profits in the intermediate period between the shock and the merger and $\tilde{\pi}_z^m$ its profits after the merger. The measured change in profits for a control firm is then given by $\Delta\tilde{\pi} = \tilde{\pi}_z^m - \tilde{\pi}_z + \rho(\tilde{\pi}_z - \tilde{\pi}_y)$. Using $\Delta\tilde{\pi}$ to control for shocks, the measured change in the merging firms' profits is given by

$$\Delta\pi^+ - \Delta\tilde{\pi} = (\pi_z^+/2 - \pi_z) - (\tilde{\pi}_z^m - \tilde{\pi}_z) - \rho\left[(\pi_z - \pi_y) - (\tilde{\pi}_z - \tilde{\pi}_y)\right]. \quad (14)$$

The profit effect is thus identified if (i) the merger has no externality on the control firms, ie $\tilde{\pi}_z^m = \tilde{\pi}_z$, and (ii) the shock affects the merging firms and the control firms in the same way, ie $\pi_z - \pi_y = \tilde{\pi}_z - \tilde{\pi}_y$.

Equation (14) suggests a trade-off between using inter- and intra-industry control groups, which depends on the relative strength of externalities and shocks, and the extent to which shocks are industry specific. With an *inter-industry* control group, the control firms are unlikely to be exposed to an externality, ie $\tilde{\pi}_z^m = \tilde{\pi}_z$, so that the second term of equation (14) vanishes. The third term may be either positive or negative, depending on the nature of the shock.[23] Assuming $\rho$ to be non-negligible, it will be close to zero only

[22] To see this, note that the measured present value of the merged entity's post-merger profits is given by $\int_0^t \pi_z^+/2e^{-rx}dx = (1 - e^{-rt})\pi_z^+/2r$, where the present value has been measured by time 0. Similarly, when measured by time $-\tau$, the present value of the merged entity's pre-merger profits is given by $\int_\tau^s ye^{-r(x-\tau)}dx + \int_s^0 ze^{-r(x-\tau)}dx = \left(1 - e^{-r(s-\tau)}\right)\pi_y/r + \left(e^{-r(s-\tau)} - e^{r\tau}\right)\pi_z/r$. Multiplying these post- and pre-merger values by $r/\left(1 - e^{-rt}\right)$ and $r/\left(1 - e^{r\tau}\right)$ respectively, yields the post- and pre-merger profits per unit of time, namely $\pi_z^+/2$ and $\rho\pi_y + (1-\rho)\pi_z$. Subtracting pre- from post-merger profits yields the desired expression.

[23] As shown by the oligopoly model in section 3, a merger may be triggered both by a positive shock, such as a reduction in the slope of demand, ie reduced $\beta$, and a negative shock, such as a reduction in the intercept of demand, ie a reduction in $\alpha$.

if the shock has a similar effect on different industries. Alternatively, in a sample of many mergers, the (average) effect may be small if some mergers are triggered by positive shocks while others are triggered by negative ones. With an *intra-industry* control group, it may be possible to control rather efficiently for the shock, ie $\pi_z - \pi_y \approx \tilde{\pi}_z - \tilde{\pi}_y$, since the evidence suggests the triggering of shocks to be industry-wide (Mitchell and Mulherin, 1996). The problem is that competing firms are exposed to an externality from the merger, ie $\tilde{\pi}_z^m - \tilde{\pi}_z = \pi^- - \pi_z$, so that $\Delta\pi^+ - \Delta\tilde{\pi} = \pi_z^+/2 - \pi_z^-$.

The preemptive merger hypothesis is a possible explanation for the different results obtained in accounting profit studies. Assume that a merger is preemptive. Then, the measured change in profit will be negative when using inter-industry control groups, at least if the shock has a similar effect on different industries or if shocks, on average, cancel out each other. In contrast, the measured change will be positive when using intra-industry control groups, since $\Delta\pi^+ - \Delta\tilde{\pi} = \pi_z^+/2 - \pi_z^-$. Thus, the observed increase in profits relative to other firms in the same industry should not be taken as proof that the mergers were profitable.[24] The important conclusion is that, if possible, one should avoid controlling for shocks by using firms likely to be exposed to an externality from the merger, eg firms active in *both* the same product market and the same geographical market.

[24] Also, positive externalities may have caused a bias. In particular, a few intra-industry studies (e.g. some country studies in Mueller, 1980) find a negative (but insignificant) effect of mergers. In our model, the only mergers occurring in equilibrium, and reducing relative profits, are those in area B of Figure 1. Thus, according to our model, if a merger reduces profits in relation to competitors, it should be concluded to be profitable and not unprofitable, as is usually the case. This result indicates that the negative impact of mergers on profits may have been overstated.

# 7 Concluding Remarks

This paper demonstrates a preemptive (or defensive) merger mechanism that may explain the empirical puzzle why mergers reduce profits and raise share prices.[25] These results may be reformulated as a critique of the empirical literature on mergers.

We have demonstrated that mergers may affect the value of firms (the sum of expected discounted profits) and profits in opposite directions. If the stock market understands merger dynamics, the change in the firms' stock market values reflects the change in their true values. If, on the other hand, the merger comes as a surprise, the change in the firms' stock market values reflects the change in their profitability. Hence, to understand the informational contents of share prices, it is essential for future event studies to empirically discriminate between the efficient market (anticipation) hypothesis and the surprise hypothesis.

It has been shown that the current practice to control for external shocks by measuring M&A performance relative to the performance of firms in the same industry, may produce biased estimates since mergers confer externalities on competitors. Finding other methods of controlling for external shocks is an important challenge for future empirical work. A minimum requirement is that one must be careful not to control for external shocks by including direct competitors in the control sample.

Some empirical studies of M&A performance use share price data, while others use accounting profits. In the past, these two types of data have been viewed as substitutes. In contrast, our results indicate that they are

[25] In Fridolfsson and Stennek (2004b), we also demonstrate why mergers may reduce competitors' share prices, even though their profits increase (as, for example, in an anti-competitive merger).

complements. Relying on share prices only, it may not be detected that unprofitable mergers occur; relying on accounting profits only, the reasons why they occur may not be understood.[26] Hence, in future empirical work, it is desirable to integrate the two types of data.

Similarly, we have demonstrated the importance of externalities for firms' incentives to merge. Hence, in future empirical work, it is desirable to integrate data on insiders and outsiders. One possibility is to classify mergers (with reference to Figure 1) as type B, C or D (and perhaps even as type A). Such an approach would also be crucial for testing the preemptive merger hypothesis. In particular, there are some residual implications of the hypothesis that can be useful for further testing, namely that outsiders lose in terms of profits as well as share prices, both in absolute and relative terms.

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[26] For example, it might be suspected that mergers motivated by empire-building reduce the stock market value of the merging firms. Since preemptive mergers increase their value, share-price data should be useful for discriminating between the two hypotheses.

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# A Appendix

**Lemma 1** *Consider the set of symmetric Markov perfect equilibria in a subgame starting after the shock has occurred. A merger-race equilibrium exists*

*iff* $\frac{r}{r+\mu}\left(\pi_z^+/2-\pi_z\right)+\frac{\mu}{r+\mu}\left(\pi_z^+/2-\pi_z^-\right)/3\geq 0$*; in such an equilibrium, the pre-merger share price is given by* $W_z=\frac{r}{r+\mu}\pi_z/r+\frac{\mu}{r+\mu}\left(\pi_z^++\pi_z^-\right)/3r$*. A no-merger equilibrium exists iff* $\pi_z^+\leq 2\pi_z$*; in such an equilibrium,* $W_z=\pi_z/r$*. A merger hold-up equilibrium exists iff* $\pi_z^+>2\pi_z$ *and* $\frac{r}{r+\mu}\left(\pi_z^+/2-\pi_z\right)+\frac{\mu}{r+\mu}\left(\pi_z^+/2-\pi_z^-\right)/3<0$ *or* $\pi_z^+<2\pi_z$ *and* $\frac{r}{r+\mu}\left(\pi_z^+/2-\pi_z\right)+\frac{\mu}{r+\mu}\left(\pi_z^+/2-\pi_z^-\right)/3>0$*; in such an equilibrium,* $W_z=\pi_z^+/2r$*.*

**Proof:** The proof of Lemma 1 is constructed using essentially two expressions. Condition (1) describes the acquisition-game equilibrium, defining $p_z$ as a function of $W_z$ and the oligopoly profit levels. Equation (5) describes the stock market equilibrium, defining $W_z$ as a function of $p_z$ and the oligopoly profit levels.

First, consider a **merger-race** equilibrium in state $z$, ie $p_z=1/2$. Then, by equations (2), (4) and (5), $W_z=\frac{r}{r+\mu}\pi_z/r+\frac{\mu}{r+\mu}\left(\pi_z^++\pi_z^-\right)/3r$. By condition (1), there is a merger race iff $W_z^+\geq 2W_z$, or equivalently $\frac{r}{r+\mu}\left(\pi_z^+/2-\pi_z\right)+\frac{\mu}{r+\mu}\left(\pi_z^+/2-\pi_z^-\right)/3\geq 0$.

Second, consider an equilibrium with **no mergers** in state $z$, ie $p_z=0$. Then, by equations (4) and (5), $W_z=\pi_z/r$. A merger does not occur iff $W_z^+\leq 2W_z$, or equivalently $\pi_z^+\leq 2\pi_z$.

Third, consider an equilibrium with **hold-up** in state $z$, ie $p_z\in(0,1/2)$. Then, by condition (1) and the definition of $W_z^+$, $W_z=\pi_z^+/2r$, which is used to eliminate $W_z$ in (4) and (5). Inserting the value of $V_z$ into equation (5) and solving for $p_z$ yields $p_z=N/D$ where $N=-3r\left(\pi_z^+/2-\pi_z\right)$ and $D=2\mu\left(\pi_z^+/2-\pi_z^-\right)$ in the generic case when $\pi_z^+/2\neq\pi_z^-$. It remains to identify the conditions under which $p_y\in(0,1/2)$. Assume that $D<0$. Then $p_y>0$ iff $N<0$ and $p_y<1/2$ iff $2N>D$. Note also that $N<0$ and $2N>D$ imply that $D<0$. Hence, a hold-up equilibrium exists if $N<0$ and $2N>D$. Note that the condition $2N>D$ is the reverse of the condition

for the existence of a merger-race equilibrium. Analogously, it may be shown that a hold-up equilibrium exists if $N > 0$ and $2N < D$, by considering the case when $D > 0$. Since we have considered all possibilities ($D < 0$ and $D > 0$), a hold-up equilibrium does not otherwise exist. *QED.*

**Lemma 2** *Assume that there is a merger-race equilibrium in state z. Then, a no-merger equilibrium in state y exists iff* $\pi_y^+ \leq 2\pi_y$ *and* $\lambda \leq \lambda_{NoMerger}$*; in such an equilibrium,* $W_y = \frac{r}{\lambda+r}\pi_y/r + \frac{\lambda}{\lambda+r}\left(\frac{r}{r+\mu}\pi_z/r + \frac{\mu}{r+\mu}\left(\pi_z^+ + \pi_z^-\right)/3r\right)$.

**Proof:** The basic idea in the proof of Lemma 2 is the same as in the proof of Lemma 1, but the algebra is less transparent. Condition (1) describes the acquisition-game equilibrium, defining $p_y$ as a function of $W_y$ and the oligopoly profit levels. Equation (6) describes the stock market equilibrium, defining $W_y$ as a function of $p_y$ and the oligopoly profit levels. The most important difference to the proof of Lemma 1 is that firms' stock market values in $y$, ie $W_y$, are also a function of the equilibrium in state $z$, since $V_z$ enters equation (6). To overcome this difficulty, we start the proof by rewriting equation (6) in the following way

$$W_y = \frac{\lambda}{\lambda+r+\mu}W_z + \frac{r}{\lambda+r+\mu}\pi_y/r + \frac{\mu}{\lambda+r+\mu}W_y, \tag{6'}$$

where we have used equation (5), noting that the first term in (6) equals $\frac{\lambda}{\lambda+r+\mu}W_z$, as well as equations (4) and the fact that $p_y = 0$ in a no-merger equilibrium in $y$. By Lemma 1, $W_z = \frac{r}{r+\mu}\pi_z/r + \frac{\mu}{r+\mu}\left(\pi_z^+ + \pi_z^-\right)/3r$ in a merger-race equilibrium in $z$. Hence, equation (6') may be rewritten as

$$W_y = \left[\frac{r}{\lambda+r}\pi_y + \frac{\lambda}{\lambda+r}\left(\frac{r}{r+\mu}\pi_z + \frac{\mu}{r+\mu}\left(\pi_z^+ + \pi_z^-\right)/3\right)\right]/r. \tag{15}$$

According to condition (1), no merger occurs in state $y$ iff $W_y^+ \leq 2W_y$, or

equivalently

$$\frac{r}{r+\lambda}\left(\pi_y^+/2-\pi_y\right)+\frac{\lambda}{r+\lambda}\left[\frac{r}{r+\mu}\left(\pi_z^+/2-\pi_z\right)+\frac{\mu}{r+\mu}\frac{1}{3}\left(\pi_z^+/2-\pi_z^-\right)\right]\leq 0.$$

By Lemma 1, $\frac{r}{r+\mu}\left(\pi_z^+/2-\pi_z\right)+\frac{\mu}{r+\mu}\left(\pi_z^+/2-\pi_z^-\right)/3 \geq 0$ when there is a merger-race equilibrium in $z$. Consequently, the inequality is fulfilled only if $\pi_y^+/2 \leq \pi_y$. Moreover, the inequality is equivalent to $\lambda \leq \lambda_{NoMerger}$, where

$$\lambda_{NoMerger} \equiv \frac{-r\left(\pi_y^+/2-\pi_y\right)}{\frac{r}{r+\mu}\left(\pi_z^+/2-\pi_z\right)+\frac{\mu}{r+\mu}\left(\pi_z^+/2-\pi_z^-\right)/3},$$

since the denominator is positive (in the non-generic case when $\frac{r}{r+\mu}\left(\pi_z^+/2-\pi_z\right)+\frac{\mu}{r+\mu}\left(\pi_z^+/2-\pi_z^-\right)/3=0$, let $\lambda_{NoMerger}\equiv+\infty$). *QED.*