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MERGER FAILURE AND MERGER PROFITABILITY*

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The focus of the paper is the effect of merger proposals on the expected profitability of the bidder and the target. We illustrate how an unsuccessful bid may increase the profitability of the target but reduce the profitability of the bidding firm, relative to the profitability of the firms before the merger offer. The profitability of a merger proposal is lowered due to learning from rejection. We use our theoretical model to explain empirical work on this issue.

I. INTRODUCTION

THEORETICAL WORK on the profitability of takeovers has rarely focused on the problem of unsuccessful merger proposals or tender offers.[1] This is unfortunate because the decision that is generally available to a firm is not whether it should merge with another firm, but, rather, whether it makes a merger proposal or tender offer. In this paper, we contend that failure to take account of this may bias estimates of the profitability of takeover attempts.

The focus of the paper is the effect of merger proposals on the expected profitability of the bidding firm and the target firm. We describe a theoretical model to show how an unsuccessful bid may increase the profitability of the target but reduce the profitability of the bidding firm, relative to the profitability of the firms before the merger offer. This is independent of any effect of potential future takeovers on the value of the firm. Consequently, the profitability of a merger proposal will be lower than in the absence of any effect conditional on rejection.

The assumption causing this result is that a target firm has private information about its profitability which is not available to the bidding firm. Assume that there is uncertainty about the profitability of the target and that the bidder offers x dollars for the target. The target accepts if its profits from not being merged are less than x and is rejected otherwise. Hence the response of the target to a merger proposal reveals information on the competitiveness or profitability of the target.

We further assume that the two firms (the bidder and target) compete in a duopolistic market and play a Cournot game in quantities if a merger does not occur. (Therefore, we are restricting attention to horizontal mergers.) In the equilibrium of our model, bidding firms that suffer rejection of their

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[1] This is true for e.g. Salant, Switzer and Reynolds [1983], Davidson and Denekere [1983], Perry and Porter [1985], and Grossman and Hart [1980].

merger offer realize that their opponents have low cost, and consequently, the bidder's expected profitability falls. If the target firm rejects the offer, then it signals that it is low cost, which we show increases its profitability at any cost level. The intuition for this result is that by rejecting the merger proposal, the bidder is known to receive information on the target's competitiveness that it would rather not have.

In the context of tender offers, Bradley, Desai and Kim [1983], have noted three possible reasons why the target firm's return may rise after rejection of a tender offer. The first possibility is that the management of the target firm may be shaken from lethargy by the tender and may begin implementing better operating policy. The second alternative is that merger rejection signals that future merger offers are likely, which Bradley, Desai and Kim support. The final possibility is that rejection of a tender offer signals information to the stock market that result in revaluation of the stock of the target firm. Our model is in this tradition.

Bradley, Desai and Kim claim that "the information hypothesis requires that certain capital agents (i.e. the managers of the bidding firms) possess ... superior knowledge regarding the operating potential of the firm" (p. 184). We show that this is not necessarily so. The idea behind our model is that the target firm has private information on its costs that it cannot reveal to the stock market. (For example, it may be difficult to signal privately held information on future markets or R&D projects.) However, only low cost firms will reject a merger proposal (since they are profitable if they do not merge) so that rejection of the offer signals that the firm is low cost. This increases the *profitability* of the target firm for any cost level and is likely to result in an increase in the returns to target firms. Thus, information transmission occurs even when the bidder has no better information than the rest of the capital market.

Before we begin the analysis, a few points are worth noting. First, we assume throughout the paper that the stock market holds no better information on the target firm than the bidder. All our results below are predicated on that assumption. If a merger bid is rejected, then it is possible that the stock price of the target rises simply because the market realizes that the firm is low cost. This insight is not novel. What is interesting, we feel, is that the *profits* of the bidder fall while those of the target rise after the rejection of a merger offer. It is not simply that the stock market realizes that the target firm will earn higher profits than it had previously thought; it is also the case that profits change.

Second, we describe the analysis in terms of merger proposals rather than non-negotiated tender offers. The reason for this is that tender offers are directly aimed at the stockholders while merger proposals are directed at shareholders through the target's management. Merger proposals must be approved by the board of directors of the target firm. The board may veto merger proposals in the US if they wish by refusing to put such proposals to

shareholders (see Smith and Robertson [1977, p. 870]). This allows the management of the target firm to reveal its information by rejection of an offer. As it is more reasonable to assume that the management has private information, rather than the shareholders, we restrict attention in the formal sections to merger proposals.

However, the insights highlighted here are not specific to merger proposals. All the results need is a response from management that reveals information on the true value of the company. For example, management can respond in a variety of ways to a tender offer, from a recommendation of acceptance to the implementation of a variety of defensive measures. Then if the defensive measures implemented by companies at least partially reflect the true underlying profitability of the company (rather than solely entrenchment activities), the tender offer is likely to reveal information which the bidder may prefer not to have revealed.[2] This issue is discussed further in the conclusion, where we also address agency concerns which may underlie many of the issues described here.

Finally we should note that the rejection of tender offers and merger proposals is rare. Hence it might be argued that the effect of the rejection of merger proposals is relatively unimportant as it does not occur frequently. However, this overlooks the fact that the likelihood of rejection is endogenous, and more specifically that bidders may make offers to ensure that the probability of rejection is low, precisely for the reasons suggested here. In this model, the way to ensure that rejection is rare is to make a generous offer to the target. Thus the target may get the lion's share of the returns to merger, perhaps the most consistent finding on the empirical literature on takeovers.

Before continuing, it should be noted that firms have a variety of instruments with which to signal costs or profitability. For example, firms can conceivably signal their costs with prices, advertising, or product quality. This paper does not argue that the merger process is any more effective a signalling device than the other instruments mentioned above. Instead, we argue that signalling through prices, advertising or product quality may be imperfect, so that there remains uncertainty about cost structures when the merger process is underway. As a result, the process of merger proposal and possible rejection can reveal information to the participants.

The role of information transmission from negotiation failure was first highlighted in the context of legal settlements by Nalebuff [1987]. Our paper is an application of this methodology. Other work which has some similarities to this is Cramton and Palfrey [1988], who examine the effect of learning from disagreement in the context of cartel information.

[2] Another reason why bidders may not overcome these information transmission effects by simply making a tender offer is that tender offers may result in free-riding by shareholders, so that they gain the returns to the merger, as highlighted in Grossman and Hart [1980]. By dealing with a single agent (management) these bargaining problems may be attenuated.

In the next section, we describe the model and show how merger rejection leads to lower profits for the bidder in the Cournot game but higher profits for the target. We follow this with an analysis of how a merger offer affects the value of each firm and how studies that ignore the problem of merger rejection may overestimate the profitability of merger offers to the bidder. We conclude with a brief discussion.

II. THE MODEL

We assume that there are only two firms in the industry, both of which are risk neutral and maximize expected profits. Firm 1 is the bidder and firm 2 is the target. We assume that firm 1 has constant marginal costs, τ, which is common knowledge.[3] Firm 2 has costs $c \in [c^-, c^+]$, where $\tau \leqslant c^- < c^+$.[4] In the following it is often convenient to refer to a particular c as firm 2's type. Firm 2 knows its costs while firm 1 does not. Firm 1 knows that c is distributed according to $F(c)$, with density $f(c)$, where $f > 0$ for all c. By assumption, firm 2 cannot signal its costs before a merger proposal.

The two firms' revenue functions are:

$$\text{Firm 1:} \quad A(q_1, q_2) \quad \text{where } A_1 > 0, A_2 < 0, A_{11} < 0, A_{12} < 0.$$

$$\text{Firm 2:} \quad B(q_1, q_2) \quad \text{where } B_1 < 0, B_2 > 0, B_{12} < 0, B_{22} < 0.$$

We assume the following standard stability condition.

$$A_{11}B_{22} > A_{12}B_{12} \tag{1}$$

The two firms may merge if they wish. The bargaining structure that we use is that the bidder (firm 1) makes a single take-it-or-leave-it offer for the target firm (firm 2). Thus all else being equal, the gains from the merger should accrue to the bidder. Denote an offer by Ω. If the target firm rejects the offer, then the two firms compete in a Cournot game, based on the bidder's beliefs of the target's cost. If the two firms merge, then we assume that the merged firm has constant marginal costs, τ,[5] and equilibrium output, q_1^m, is determined by the solution to

$$A_1(q_1^m, 0) = \tau$$

Let Π^m be the profits earned by the bidder if he is a monopolist. Hence the

[3] As discussed in the conclusion the assumption of one-sided asymmetric information rather than two-sided asymmetric information where both firms have private information about their costs is not important for illustrating the effect of merger rejection on the subsequent payoffs for the firms. It does simplify the analysis considerably as it rules out any signalling by the bidder via the bid.

[4] The assumption that the bidder's costs are lower is not important; it merely allows us to ignore the possibility of technology requisition as a motive for merger.

[5] Allowing monopoly profits to be a convex combination of the bidder's and target's profits does not change the insight that after rejection, information revealed causes profits to change. It will, of course, change the equilibrium offer.

payoffs to firms 1 and 2 if an offer of Ω is accepted are $\Pi^m - \Omega$ and Ω, respectively.

To find the equilibrium payoffs when an offer is rejected we proceed in three steps. First we consider the equilibrium outcome when c is known to all. Second we consider the equilibrium if no offer is made. Finally the case where offers are made and rejection may occur is analyzed.

Consider first the case where firm 1 knows c, the cost of firm 2. In this case, the Cournot Nash equilibrium, (q_1^f, q_2^f), is the solution to[6]

$$A_1(q_1^f, q_2^f) = \tau \tag{2}$$

$$B_2(q_1^f, q_2^f) = c \tag{3}$$

Write the equilibrium profits of firm i as a function of c as $\Pi_i^f(c)$. Note that, using our stability assumption in (1),

$$\frac{dq_1^f}{dc} = \frac{A_{12}}{A_{12}B_{12} - A_{11}B_{22}} > 0$$

$$\frac{dq_2^f}{dc} = \frac{A_{11}}{A_{11}B_{22} - A_{12}B_{12}} < 0$$

Hence, the lower is c, the lower is q_1^f and the higher is q_2^f. It is easy to show that a fall in c increases the equilibrium profit of firm 2 and decreases the equilibrium profit of firm 1. Finally, the shift in firm 2's best reply function from a change in c is always in the same direction implying that $q_2^f(c)$ is monotone in c.

Consider next the case where no offer is made. Given the assumed asymmetry on information, the strategy of firm 2 is a random variable from the point of view of firm 1. Using the sequential equilibrium concept (so that Bayes Law holds on the equilibrium path), the Cournot equilibrium is found by maximizing

$$\max_{q_1} \int_{c^-}^{c^+} A(q_1, q_2(c)) f(c)\, dc - \tau q_1$$

$$\max_{q_2} B(q_1, q_2) - cq_2 \qquad \text{for all } c \in [c^-, c^+]$$

The equilibrium output levels $(q_1^{no}, q_2^{no}(c))$ are the solutions to

$$\int_{c^-}^{c^+} A_1(q_1^{no}, q_2^{no}(c)) f(c)\, dc = \tau \tag{4}$$

$$B_2(q_1^{no}, q_2^{no}(c)) = c \qquad \text{for all } c \in [c^-, c^+] \tag{5}$$

[6] We assume that the solution to (2) and (3) is such that if $c = c^+$, output is positive so that there is no possibility of firm 2 closing down with the market degenerating to monopoly.

The quantity that firm 1 produces depends on the expected output that firm 2 will produce, which depends on expected cost. Since the target firm cannot verify its costs to the bidder, Cournot equilibrium depends on the actual cost level of the target and the bidder's belief about this. The expected profits to the two firms without a merger offer are given by

$$\Pi_1 = \int_{c^-}^{c^+} A(q_1^{no}, q_2^{no}(c)) f(c)\, dc - \tau q_1^{no}$$

$$\Pi_2(c) = B(q_1^{no}, q_2^{no}(c)) - c q_2^{no}(c) \tag{6}$$

An example:

Consider the case where both firms have an inverse demand function

$$p = a - q_1 - q_2$$

where p is the price of output and the slope has been normalised to -1. Let $\tau = 0$ and let the marginal cost of the target be uniform on the interval [0, 1]. Then

$$q_1^{no} = \frac{a}{3} + \frac{1}{6}$$

and

$$q_2^{no}(c) = \frac{a}{3} - \frac{1}{12} - \frac{c}{2}$$

with profits of firm i given by $\Pi_i = (q_i^{no})^2$.

Finally, consider the effect of rejection of the offer. When the bidder makes an offer that is rejected, he may be able to draw further inference about the cost level of the target. To illustrate this, we first identify the types of targets who turn down a particular offer. Consider an offer Ω which some type $\hat{c}$ rejects given the revised belief of the bidder and the effect thereof on the ensuing Cournot duopoly game. Let the equilibrium output choice of firm 1 given its belief be $\hat{q}$. Then the profit of any given type of firm 2 who reject the offer is given by

$$\Pi_2 = B(\hat{q}, q_2) - c q_2$$

Differentiation w.r.t. c and noting that q_2 is chosen optimally yields

$$\frac{d\Pi_2}{dc} = [B_2 - c]\frac{dq_2}{dc} - q_2 = -q_2 < 0$$

Hence all types $c < \hat{c}$ will earn greater profits in the duopoly game and hence they will also reject the offer. Let $R(\Omega)$ be the set of types who reject Ω. Three cases can arise:

Case 1: If $\Omega \leqslant \Pi_2^{no}(c^+)$ all types reject the offer and $R(\Omega) = [c^-, c^+]$.

Case 2: If $\Omega \geqslant \Pi_2^f(c^-)$ all types accept the offer and $R(\Omega) = 0$.

Case 3: In this intermediate case $R(\Omega) = [c^-, k(\Omega))$ where $k(\Omega)$ is defined as the type who, given the inference that this is the highest cost type that rejects an offer, is indifferent between accepting and rejecting the offer. Hence it is the k which solves

$$\Omega = \Pi_2^*(k) = B(q_1^*, q_2^*(k)) - kq_2^*(k) \tag{7}$$

where q_1^*, q_2^* are defined by

$$\int_{c^-}^{k(\Omega)} \frac{A_1(q_1^*, q_2^*(c))}{F(k(\Omega))} f(c)\,dc = \tau \tag{8}$$

$$B_2(q_1^*, q_2^*(c)) = c \qquad c \in [c^-, k(\Omega)] \tag{9}$$

Thus we can write $R(\Omega)$ as:

$$R(\Omega) = \begin{cases} [c^-, c^+] & \text{for} \quad \Omega \leqslant \Pi_2^{no}(c^+) \\ [c^-, k(\Omega)) & \text{for} \quad \Pi_2^{no}(c^+) \leqslant \Omega \leqslant \Pi_2^f(c^-) \\ \varnothing & \text{for} \quad \Pi_2{}^f(c^-) \leqslant \Omega \end{cases}$$

In case 3 the expected profits when an offer is rejected depend on the true type and the offer made (which determines $k(\Omega)$). We can write these as:

$$\Pi_1(\Omega) = \int_{c^-}^{k(\Omega)} \frac{A(q_1^*, q_2^*(c))}{F(k(\Omega))} f(c)\,dc - \tau q_1^*$$

$$\Pi_2(\Omega, c) = B(q_1^*, q_2^*(c)) - cq_2^*(c)$$

where output levels are determined from (8) and (9).

Lemma 1. When an offer is rejected, the profit of the target is increasing in the offer Ω. The profit of the bidder is decreasing in the offer.

Proof. First assume that $\partial k/\partial\Omega < 0$. Since $\partial\Pi_i/\partial\Omega = (\partial\Pi_i/\partial k)(\partial k/\partial\Omega)$, we need to show that $\partial\Pi_1/\partial k > 0$ and $\partial\Pi_2/\partial k < 0$. Totally differentiating (8) yields

$$\frac{f(k)}{F(k)}\left[A_1(q_1^*, q_2^*(k)) - \frac{\int_{c^-}^{k} A_1(q_1^*, q_2^*(c)) f(c)\,dc}{F(k)}\right] dk$$

$$+ \frac{1}{F(k)}\left[\int_{c^-}^{k} \frac{1}{B_{22}}(A_{11}B_{22} - A_{12}B_{12}) f(c)\,dc\right] dq_1 = 0$$

Since $\partial q_2^*/\partial c < 0$ and $A_{12} < 0$; $dA_1/dc > 0$ and the term in the first bracket of the equation is positive. Given (1), the term in the second bracket is negative, implying that $\partial q_1^*/\partial k > 0$. Intuitively the bidder's expectation of the target's reaction curve shifts down towards the origin. Also note that $\partial q_2^*/\partial k = (\partial q_2^*/\partial q_1^*)(\partial q_1^*/\partial k) < 0$ for any level of c, as the goods are strategic

substitutes. Then

$$\frac{\partial \Pi_1}{\partial k} = E\left[A_2 \frac{\partial q_2}{\partial k} + (A_1 - \tau)\frac{\partial q_1}{\partial k}\right] > 0 \tag{10}$$

and

$$\frac{\partial \Pi_2}{\partial k} = B_1 \frac{\partial q_1}{\partial k} + (B_2 - c)\frac{\partial q_2}{\partial k} < 0 \tag{11}$$

since $\partial q_2^*/\partial k < 0$, $\partial q_1^*/\partial k > 0$ and marginal cost is never less than expected marginal revenue. Hence if $\partial k/\partial \Omega < 0$, the expected post-rejection Cournot profits of the bidder decrease in the bid and the profits of the target increase with the bid.

But $\partial k/\partial \Omega < 0$. To see this, assume the contrary. If $\partial k/\partial \Omega \geqslant 0$, this implies that if an offer of Ω and $\Omega^* > \Omega$ are made, from (11) the post-rejection Cournot profits to the target are no higher after rejecting Ω^* than Ω. Then since the target accepts an offer x if $x \geqslant \Pi_2(x, c)$, this implies that there exists some c^* which will accept Ω^* but not Ω. Hence there is a contradiction, so that $\partial k/\partial \Omega < 0$ and the Lemma follows. □

Returning to our linear example, it is straightforward to compute expected profits as

$$\Pi_1(\Omega) = \left(\frac{a}{3} + \frac{k(\Omega)}{6}\right)^2 \tag{12}$$

and

$$\Pi_2(\Omega, c) = \left(\frac{a}{3} - \frac{k(\Omega)}{12} - \frac{c}{2}\right)^2 \tag{13}$$

where Ω is determined as the offer which makes type k indifferent between this offer and rejecting it to get $\Pi_2(\Omega, k)$, i.e.

$$\Omega = \left(\frac{a}{3} - \frac{7}{12}k(\Omega)\right)^2 \tag{14}$$

Note that the bidder's expected profits are increasing in k while the target's are decreasing in k. This is the key to the paper. In a Cournot duopoly, an uninformed party would prefer not to have information on its opponent's costs than for the information to become commonly available that the informed party has low costs. Hence merger rejection reveals information that the bidder would prefer not to be revealed.

It is important to realize that mergers that are rejected harm the bidder in a way that would not occur if the two firms competed as duopolists with no merger offer. The importance of receiving information is not, of course, that the information itself is harmful but that the other firm knows that the bidder holds that information. To put this in more familiar terms, it is known with

probability one that the bidder knows that costs are less than $k(\Omega)$ for any offer of Ω that is rejected. If it is known (with probability one) that the target is low cost, the target increases its output and the bidder reduces its output. In this way, the bidder loses from a rejected offer.

The effect can be illustrated by looking at a set of reaction curves, see Tirole [1988, p. 363]. Figure 1 below shows the reaction curve of the bidder R_B as well as five reaction curves for the target. The two extreme correspond to the extreme cost types. The middle curve, $E(R_T)$ is the bidder's unconditional expectation of the target's reaction curve. Thus, if no further information is obtained, the bidder would expect A to be the Cournot equilibrium. If an offer is rejected, then the reaction curve of the marginal type, k, will be the lowest reaction curve of any target. This implies that the bidders expectation of the targets reaction curve is shifted outwards to $E(R_T \mid \text{rejection})$ yielding expected equilibrium B. As the profit of the bidder decreases as we move up R_B, the expected profits of the bidder decreases as fewer firms reject the offer (k decreases).

III. THE BIAS FROM IGNORING REJECTIONS

In empirical studies, the profitability of mergers that have occurred is

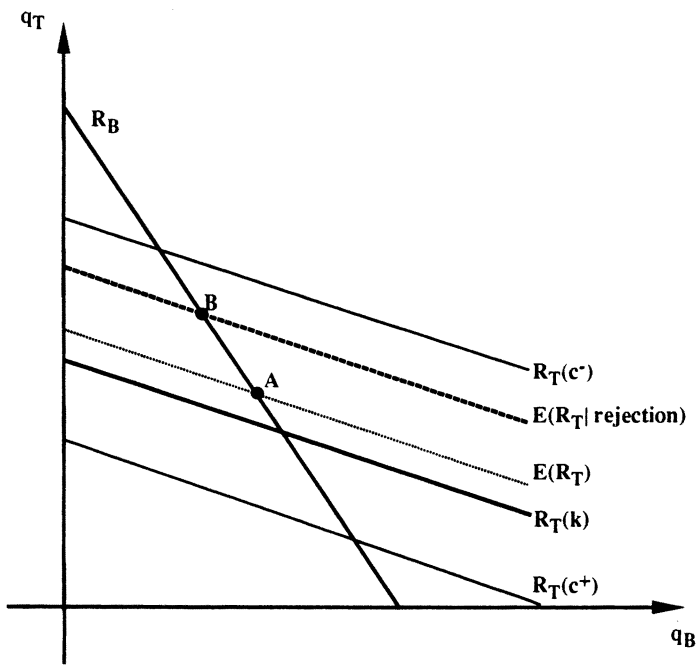

Figure 1

typically measured by

$$\Pi^m - \Omega - \Pi_1(0) = \Delta\Pi(0) \tag{15}$$

where $\Pi_1(0)$ is the duopoly profit of firm 1 when no offer is made ($\Omega = 0$). The true gains from making an offer of Ω are

$$[1 - F(k(\Omega))] \cdot (\Pi^m - \Omega - \Pi_1(0)) + F(k(\Omega)) \cdot (\Pi_1(\Omega) - \Pi_1(0)) = \Delta\Pi(\Omega)$$

which is less than $\Delta\Pi(0)$ for any Ω at which rejection occurs with positive probability. It may be the case that $\Delta\Pi(0) > 0$, but that $\Delta\Pi(\Omega) < 0$, because there are severe costs to merger failure. Hence the effect of merger rejection illustrated here makes merger proposals less likely and thus using (15) to predict the number of mergers may lead to an upwards bias and a conclusion that too few mergers have occurred.

IV. EQUILIBRIUM MERGER OFFER

We now consider the effect of rejection of an offer on the pre-offer expected profitability of a merger offer for both the bidder and the target. The expected profits to a bidder who offers Ω is

$$V_1(\Omega) = [1 - F(k(\Omega))] \cdot (\Pi^m - \Omega) + F(k(\Omega)) \cdot \Pi_1(\Omega) \tag{16}$$

while the utility to the target is given by

$$V_2(\Omega, c) = [1 - F(k(\Omega))] \cdot \Omega + F(k(\Omega)) \cdot \Pi_2(\Omega, c) \tag{17}$$

The problem of the bidder is to choose Ω to maximize (16). The first order condition for an interior solution is:[7]

$$[1 - F(k(\Omega))] = -\frac{\partial k(\Omega)}{\partial \Omega}\left(\Pi^m - \Omega - \Pi_1(\Omega) - \frac{F(k(\Omega))}{f(k(\Omega))}\frac{\partial \Pi_1(\Omega)}{\partial k(\Omega)}\right) f(k(\Omega)) \tag{18}$$

where $\partial\Pi_1/\partial k < 0$ from Lemma 1. There are two effects in operation here. If the merger rejection did not affect future profits, the bidder's first order condition is reduced to

$$1 - F(\hat{k}(\Omega)) = -\frac{\partial \hat{k}(\Omega)}{\partial \Omega} f(\hat{k}(\Omega))\,[\Pi^m - \Omega - \Pi(0)]$$

[7] With a corner solution where the offer is always accepted, the beliefs of the bidder conditional on an off-the-equilibrium-path rejection of the offer cannot be determined by Bayes Law. However, this is not a problem here as the bidder offers Ω^* where

$$1 = -\frac{\partial k(\Omega^*)}{\partial \Omega^*}[\Pi^m - \Omega^* - \Pi_1(\Omega^*)] \quad \text{where } k(\Omega^*) = c^-$$

Then type c^- accepts the bidder's offer and there is no sequential equilibrium where the offer is always accepted other than this. This is because the target cannot threaten the bidder with off the equilibrium path beliefs such that the target earns more profits than if the target truly is type c^-.

where $\hat{k}$ is the marginal type to reject the offer Ω when the effect of rejection is ignored. It is defined by $\Omega = \Pi_2(0, \hat{k})$. The left hand side is the expected marginal financial cost of the merger. The right hand side is the marginal gain in profits earned from the merger. Allowing for the affect of merger failure on future profits has two effects. First, as $\Pi_1(0) > \Pi_1(\Omega)$, the firm's return to merger is higher than with no updating. This leads to a higher merger offer. On the other hand, the remaining term in (18) $F(k)\,\partial\Pi_1/\partial k$ is the expected cost of failure in post merger oligopoly game. But profits in this game are decreasing in Ω so that this leads the bidder to offer less for the target. The net effect of these incentives cannot be signed without more information on the distributions.

We have assumed that there is no cost to making a merger proposal. However, if mergers are costly to instigate, this analysis suggests that merger proposals will be less likely than when rejection is costless. Without further information however, we cannot say whether the effect of merger rejection increases or decreases any offer made. The reason for this is that the expected cost of rejection has two components: how often rejection occurs and the cost of any given rejection. Increasing the offer by the bidder reduces the likelihood of a rejection as only very low cost targets reject high offers; however, on the other hand, rejection of a high offer signals that the target has very low cost so that the bidder's subsequent profits fall considerably (more than if the bidder did not know that the target has low cost).

Returning to our linear example, routine calculations show that the expected profit from making an offer of Ω is:

$$V_1(\Omega) = \left(1 - \frac{4}{7}a + \frac{12}{7}\Omega^{1/2}\right)\left(\frac{a^2}{4} - \Omega\right) + \left(\frac{4}{7}a - \frac{12}{7}\Omega^{1/2}\right)\left(\frac{3}{7}a - \frac{2}{7}\Omega^{1/2}\right)^2$$

For an interior solution we require that $\Omega^{\min} \equiv (a/3 - 7/12)^2 \leqslant \Omega \leqslant (a/3)^2 \equiv \Omega^{\max}$. It can be shown that $V_1(\Omega)$ is concave on this interval. Further, $dV_1(\Omega^{\min})/d\Omega > 0$ implying that any equilibrium value of Ω must be larger than $\Omega^{\min}$. For an interior solution we need $dV_1(\Omega^{\max})/d\Omega < 0$. This can be shown to be true for $a < 7^3/24$. Thus if firm 2 is not too efficient relative to the strength of demand, the offer made implies a positive probability of a rejection.

Returning to the profit of a target who has rejected an offer Ω note that, from (17),

$$\frac{\partial V_2(\Omega, c)}{\partial \Omega} = [1 - F(k(\Omega))] + f(k(\Omega)) \cdot (\Pi_2(\Omega, c) - \Omega)\frac{\partial k(\Omega)}{\partial \Omega} > 0$$

as $\Pi_2(\Omega, c) \leqslant \Omega$, by definition. Hence, the utility of the target firm is strictly increasing in the merger offer. Therefore we would expect the stock price of target firms to rise once an offer is made. If the merger is rejected, then the

stock price of the bidder will fall below its level before the offer is made. However, the stock price of the target will not fall to its pre-offer level as it is now common knowledge that it has low costs. Merger failures aid targets but harm bidders.

We should stress that the revaluation of the stock price of the target following a rejection is not solely due to more information being available to the stock market, but also because the target actually has become more profitable for any type.

V. DISCUSSION

Various authors have examined the effect of unsuccessful tender offers and merger proposals on the returns to bidding and target firms. Bradley [1980] and Dodd and Ruback [1977] have found that firms that are the target of unsuccessful tender offers have higher returns than before the tender offer. Bradley has also shown that the post-rejection return exceeds the per share premium of the rejected bid. Similarly, Dodd [1980] has shown that the stockholders of target firms realize, on average, a gain of 11 percent after the rejection of a merger proposal. On the other hand, Asquith [1983] has found that the return to the bidding firm falls (over the long run) after an unsuccessful offer. (He does not distinguish between tender and merger offers.) Similar evidence for tender offers is found in Bradley, Desai and Kim [1980]. Dodd finds little significant effect on the returns to unsuccessful bidders relative to before offering merger proposals.

Pickering [1983] presents qualitative evidence obtained from questionnaires and interviews with firms involved in abandoned mergers in the UK for the period 1965–75. Although no clear conclusions emerge it was pointed out that the level of the initial offer was a key strategic issue. Also on UK data, Holl and Pickering [1988] compare three outcomes of merger activity; actual, abandoned and contested mergers. They argue that abandoned mergers may serve as a useful control group when assessing the success of actual mergers. Our results would suggest that abandoned mergers may not give much guidance on how the actual merged firms would have performed had the merger not occurred. Holl and Pickering [1988] also find that the profitability of the target of an abandoned merger increases after abandonment as our model suggests. Unfortunately they do not carry out the same comparison for pre-and post-abandonment performance of the bidders. Such comparison is carried out in Taffler and Holl [1991]. Looking at UK data for the period 1977–81 they find no significant difference between pre- and post-abandonment performance. However, in none of the UK studies is a distinction made between causes of abandonment. Thus the samples contain some mergers which were rejected by the Monopolies and Mergers Commission rather than by management or shareholders. Our analysis suggests that it would be worthwhile making such a distinction.

On the assumption that the target's costs cannot be verified to the market, we have developed a simple model to explain the effect of merger rejection on the profitability of merger offers which is consistent with this evidence. We have chosen asymmetric information on the costs of the target purely for simplicity. The principle that we are highlighting is that the target may have information that is revealed by the rejection of a merger offer. An alternative unobservable variable that we might consider is the level of expected demand. Suppose that the demand for the target's firm is known only to the target. Then merger offers will be rejected by those firms that feel that demand is likely to be high in future periods. This will increase the target's expected profits and, consequently, the share price. The effect on the bidder's profitability is ambiguous. If the demand signal refers to the demand level for the market, then the share price of the bidder is likely to rise. On the other hand, if the demand information signals that the target will increase its market share at a constant market size, then the bidder's returns are likely to fall. The methods required to show these results are identical to those here and are available on request.

One interesting point from these alternatives is that the target always gains, while effect on the bidder is ambiguous. This is consistent with Dodd's evidence, which show clear gains to target firms though an ambiguous effect on the returns to the bidder.

Despite the media attention that hostile takeovers attract, non-negotiated tender offers are the exception rather than the rule (Comment *et al.* [1985]). In 1984, the frequency of negotiated mergers was 2/3 of all successful mergers. This suggests that the role of the target's management is important. The reason for the frequency of negotiated offers seems to be that the tendering response of shareholders is considerably higher for negotiated offers than for non-negotiated offers (Comment *et al.*). It seems, therefore, that the opportunities for information transmission available to target management may be significant.

This paper has not explicitly considered agency problems, such as managers obtaining personal benefits from running the organization at the expense of shareholders. Such a possibility may result in managers rejecting proposals simply for entrenchment reasons, rather than signalling costs. Instead, we have argued that mergers may not occur due to inefficiencies in the bargaining process.

However, the fact that the takeover does reduce costs suggests that agency concerns may underlie the assumed technology. An important question that needs to be asked is under what conditions the results above are consistent with these agency concerns. Clearly, if the manager of the target firms has compensation which is independent of the firm's profits, then if he obtains personal benefits from running the firm, rejection of an offer merely reflects entrenchment rather than efficiency. However, the compensation of executives is often tied to the performance of their firms (Rosen [1992]), so

that agency problems of this type may be partially mitigated by introducing some congruence between the preferences of the manager and the shareholder. However, this congruence is unlikely to be complete, perhaps because of standard risk aversion or limited liability problems. As a result, when merger offers are rejected there is a signal extraction problem that needs to be performed by the bidder, where the noisy signal is likely to have some probability of being generated by entrenchment reasons, but some probability of being generated by efficiency reasons. Hence a more realistic model, though more complex, is likely to retain some of the features descibed here.

It is important that we be able to test this model. The existing empirical literature is unsatisfactory for our purposes for two reasons; first, it does not restrict attention to horizontal takeovers and second, the response of stock prices to merger failure could be for many reasons. One way of testing this model is to consider how merger proposals which are rejected by the targets management affect the stock market compared to those who are rejected for other reasons, such as those in the UK who are rejected by the Monopolies and Mergers Commission. If the model is correct the increase in the target's return should be higher for management rejections than for rejections by the Monopolies and Mergers Commission. Opposite results would be expected for the bidding firm.

The qualitative effects of a merger rejection extends to the case of two-sided asymmetric information although the analysis is complicated considerably by the possibility that a bidder may attempt to signal its costs to the target via the size of its offer. Nothing new is added to our analysis in the pooling equilibria as can be seen from Figure 1 by assuming that R_B is the target's prior expectation of the bidder's reaction curve. In the separating equilibria, if there were no effects from a merger rejection, each type of bidder would like to make the target infer that the bidders costs were low as this shifts the expected reaction curve of the bidder outwards to the right. When a rejection is a possibility, this will shift the expected reaction curve of the target outwards as well. Thus the joint effect of a bid when rejected is an expected increase in both firms output levels and hence a fall in expected profits. From this it is unclear what type of bidder would be willing to make a bid which is not accepted by all types of targets, nor is it clear whether an equilibrium can be found in which bids are rejected with positive probability.

As argued above, the information transmission effect of merger rejection extends to the case of two-sided asymmetric information about costs. Notwithstanding this, there are certain scenarios which have been ignored here. First, it would be desirable to endogenously choose the order of moves, where it might be possible to say whether the least informed party is likely to move first or vice versa. Second, the bargaining structure (take-it-or-leave-it) is restrictive; again, it would be desirable to allow counteroffers. We left out these extensions for reasons of tractability; for example, choosing who

moves first in a model of two-sided asymmetric information where the payoffs of both parties in the Cournot game depend on the types of *both* parties (through strategic substitutability) is a far from trivial extension. Future research may help to understand the robustness of these insights to other assumptions.

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