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Authors
Gilbert, Richard J.
Newbery, David M.

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UNIVERSITY OF CALIFORNIA, BERKELEY

Department of Economics

Berkeley, California 94720

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Richard J. Gilbert and David M. Newbery

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Abstract

Entry into an industry can occur through direct investment or by acquisition of an existing firm's assets. An entrant can acquire an existing firm at below its current value by credibly threatening to enter de novo, which would lower the target's value. Acquisition can be profitable even if there are more bidders than targets. We show that acquisition may or may not be more advantageous than direct entry and we characterize the dynamic evolution of an industry faced by successive entrants. The use of shark repellent to deter acquirers may benefit shareholders.

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Entry, Acquisition, and the Value of Shark Repellent

by

Richard J Gilbert and David M. Newbery[1]

University of California at Berkeley

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1. Introduction

The economic literature on entry and entry deterrence has focused on the addition of capital by a new competitor in an industry, although an alternative and commonplace mode of entry is through the acquisition of the assets of existing firms. In a study of 90 entry events in 31 markets over the period 1972–79, Yip (1982) found that one–third occurred through acquisition of existing firms' assets. Acquisitions accounted for 70 percent of the 3,788 entry events by 33 companies over the period 1950–86 examined by Porter (1987). The exploitation of complementary assets is one reason given for entry by acquisition (as in the acquisition of the Miller brewery by Philip Morris, which claimed the sharing of marketing expertise), yet it is unlikely that all or even most of the examples of entry by acquisition can be justified by asset complementarities. With or without complementary assets, acquisition should be considered as a viable alternative path (in the sense of Caves and Porter, 1977), by which entrants can gain a foothold in a new industry.

Merger law has long distinguished between entry by direct investment and entry by acquisition of existing firms' assets. The Merger Guidelines of the U.S. Department of Justice cite the elimination of a potential competitor as possible grounds for challenging a proposed merger. As an example of merger policy in a more stringent period, the Federal Trade

[1] Written whilst Newbery was visiting Berkeley from Cambridge University, England. He is indebted to the University of California for summer research support. We are grateful to Joe Farrell, Drew Fudenberg and Michael Katz for helpful comments.

Commission denied the attempt by Procter & Gamble to acquire the Clorox Corporation, arguing that P&G was a potential direct entrant in the market for household bleach and that acquisition would eliminate P&G as a competitor.[2]

Treating *de novo* entry and acquisition as alternative means to gain access to an industry lends a different perspective on the incentives to acquire a firm and to oppose takeover attempts. Grossman and Hart (1980) observe that competition to acquire a firm will bid up the price of the firm to its post–acquisition value, leaving the acquirer with no surplus for his efforts. In the entry game a potential acquirer has the option of choosing direct entry rather than acquisition. A firm would choose to enter an industry, if it can do so at a profit, rather than dissipate the profits from acquisition by competing with other bidders. The threat of entry in turn lowers the value of remaining in the industry and thus lowers the reservation price of the seller. In general, a bidding contest does not eliminate the gains from acquisition when there are profits from direct entry.

Costly tactics such as poison pills and shark repellents used to defend against aggressive takeovers have been scrutinized for their effects on shareholder value.[3] Shleifer and Vishny (1986) argue that these defensive tactics can be consistent with value maximization because they enable strong firms to delay a takeover long enough to allow other potential acquirers to collect information and enter a higher bid. Our paper identifies another way in which defensive tactics can benefit shareholders. By repelling a potential acquirer, the firm can direct the acquirer to another established firm and if a competitive firm is acquired, the shareholders of the original target gain from the elimination of a potential competitor.

In what follows, we characterize the conditions that favor entry versus acquisition for

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[2] Federal Trade Commission *v.* Proctor & Gamble Co., 386 U.S. 568 (1967).

[3] The term poison pill, according to Shleifer and Vishny (1988), refers to a class of defenses that are costly to the target firm, but make a takeover less likely by diluting a bidder's equity holdings, revoking his voting rights, or forcing him to assume unwanted financial obligations if the target is acquired. Shark repellent is any tactic that makes a takeover more difficult or less desirable, including activities that lower the value of the firm (such as the payment of greenmail or an increase in pension fund obligations) or increase the firm's debt (thus making it more difficult for a cash–constrained raider to finance the takeover).

the case of a single entrant. Section 2 shows that acquisition is always desirable if the industry is a monopoly or if the number of established firms is one less than the free entry number. The presence of substantial entry barriers makes acquisition more attractive to a potential entrant by reducing the threat value of *de novo* entry. Alternative bargaining models for division of the surplus from acquisition with an entry threat are discussed and a subgame perfect Nash equilibrium is specified for the case in which acquisition and defending a takeover attempt are costly.

Section 3 analyzes the value of "shark repellent". Even if a target firm could not defend itself against a determined takeover attempt, measures which make acquisition more difficult can be valuable to shareholders because they induce a potential acquirer to seek other targets. If a firm can succeed in steering a potential acquirer to another established firm, shareholders enjoy the benefits of reduced (potential) competition and need not acquiesce to a takeover threat. An exception is that if all but one firm have applied measures that would prevent acquisition, the last firm cannot improve shareholder value with shark repellent.

Section 4 considers multiple potential entrants and describes the dynamics of industry structure when potential entrants arrive sequentially and firms behave as Cournot–Nash competitors. If there are more than one firm in the industry initially and if all firms have the same technology, entrants will choose direct entry until the industry reaches almost the free–entry number of firms. At that point all subsequent entrants will prefer to acquire existing firms. This process will continue unless the firms are protected against takeover attempts with an effective shark repellent or direct entry occurs, either exogenously or because entrants cannot finance an aquisition.

2. The model with a single entrant

Consider an industry with n established firms and one potential entrant. Let π_i^n be the net profit including any sunk costs of the ith firm when there are n firms in the industry, and let the subscript e refer to the entrant. Suppose that the potential entrant offers to buy firm i at a price $K/(1-\beta)$, where β is the discount factor (so the sum is equivalent to a stream of payments of K per period forever). Suppose that if he is accepted, the entrant can operate the firm at the same costs as the original owner, but that if he is rejected, he can enter and earn profits π_e^{n+1}. (The superscript indicates that n+1 firms will then operate – we are supposing that no firms will be forced out of the industry).

If the entrant could commit to enter if his offer were refused, which is assumed in this section, then he need offer no more than $K = \pi_i^{n+1} + \varepsilon$ (per period), where ε is arbitrarily small (but positive), as π_i^{n+1} is the maximum profit the incumbent could earn if he rejected the offer and the entrant carried out its threat and entered. The entrant would make such an offer if it yielded higher profits than the alternative of entering *de novo*; i.e. if

$$\pi_i^n - \pi_i^{n+1} > \pi_e^{n+1}. \qquad (1)$$

Depending on the costs of the incumbent and the entrant, the degree and nature of competition in the industry, and the number of firms, *n*, acquisition may or may not be more attractive than entry. It is possible to construct examples in which acquisition is more attractive than *de novo* or direct entry for some ranges of values of *n*, and direct entry is more attractive than acquisition over the complementary ranges. However, for all cost and competitive regimes, we have the following result:

Proposition 1: Provided the entrant does not have significantly lower costs than the incumbent it is always more profitable to acquire an existing monopolist than to enter directly.

Proof: Since $\pi_1^1 > \pi_1^2 + \pi_e^2$ (monopoly profits are greater than total industry profits under duopoly), condition (1) is automatically satisfied. QED.

Inequality (1) provides insight into the consequences of barriers to entry on the decision to acquire an existing firm rather than enter *de novo*. Gilbert (1988) defines a barrier to entry as a rent that is derived from incumbency. The measure of this rent is the difference $\pi_i^n - \pi_e^n$. In a perfectly contestable market, as defined by Baumol, Panzar and Willig, (1982), an incumbent firm has no advantage relative to a potential competitor. In this case $\pi_i^{n+1} = \pi_e^{n+1}$ and the acquisition condition reduces to $\pi_i^n > 2\pi_i^{n+1}$. When barriers to entry exist, $\pi_i^{n+1} > \pi_e^{n+1}$, and relative to the perfectly contestable market case this favors acquisition, provided that $\pi_e^{n+1} > 0$ so that the potential entrant has a potent direct entry threat. If the conditions of entry are such that $\pi_e^{n+1} < 0$, an incumbent firm need not be concerned about the threat of direct entry and a potential entrant has no credible bargaining power to improve the terms of the acquisition.

The existence of complementary assets favors acquisition by raising the value of π_i^n to the acquiring firm, while leaving the threat values π_i^{n+1} and π_e^{n+1} unchanged. If the cost characteristics of a firm are not transferable to an acquirer, then π_i^n is replaced by π_e^n. Relative to the case where the entrant could target the incumbent firm with the largest surplus, $\pi_i^n - \pi_i^{n+1}$, this lowers the value of acquisition. But compared to the case in which all firms are identical, the weak entrant may be more or less inclined toward acquisition, because the values of both acquisition and direct entry are reduced. We assume in the rest of the paper that corporate assets are transferable to new shareholders, so that $\pi_e^n = \pi_i^n$.

Further results on the relative attractiveness of acquisition and entry require a more specific model of competition in the industry. As an example, suppose that the existing firms are Nash–Cournot competitors[4] and that the total cost of producing x_i units of output in the *i*th firm is

$$C_i = m_i x_i + F_i. \tag{2}$$

4 The same arguments will apply for any mode of oligopolistic competition provided the profits of each firm decline with the number of competitors.

The demand schedule facing the industry when n firms operate is

(3) $$P = a - X^n;\ X^n \equiv \sum_{i=1}^{n} x_i.$$

If the firms behave as Nash–Cournot competitors, their equilibrium profits when *n* firms operate will be

(4) $$\pi^n = \left\{\frac{a + M^n}{n+1} - m_i\right\}^2 - F_i,\ M^n \equiv \sum_{i=1}^{n} m_i.$$

Let N be the equilibrium size of the industry above which entry *de novo* is unattractive. If firms are numbered so that the first is the most profitable, the second the next most profitable, etc., then

$$N = \underset{n}{\text{argmax}}\{\pi^n \geq 0\}.$$

In the symmetric case in which all firms are identical, and have variable costs m, and fixed costs F, the free–entry equilibrium number of firms, N, is

$$N = \underset{n}{\text{argmax}}\left\{\left[\frac{a - m}{n+1}\right]^2 - F > 0\right\},$$

or

$$\left[\frac{a - m}{N+1}\right]^2 \geq F \geq \left[\frac{a - m}{N+2}\right]^2$$

Provided N is large, this gives an approximate expression for F:

(5) $$F \cong \left[\frac{a - m}{N+1}\right]^2.$$

The former inequality constraining F can now be combined with the expression for π_e^{n+1} and condition (1) evaluated. Acquisition is preferable to direct entry if:

(6) $$\left[\frac{a - m}{n+1}\right]^2 - \left[\frac{a - m}{n+2}\right]^2 > \left[\frac{a - m}{n+2}\right]^2 - \left[\frac{a - m}{N+1}\right]^2.$$

This condition is satisfied if

(7) $$N < \frac{(n+1)(n+2)}{\sqrt{(n^2 - 2)}} - 1.$$

Direct entry is more profitable for $n > n_0$, and for $n < N - k$, where $N - k$ is the largest value of n for which inequality (7) is satisfied. For $N > 7$, $n_0 = 1$ and $k = 2$ or 3, (depending on whether the value for F in (5) is better approximated by N+1 or N+2 on the right hand side), though for $N \leq 7$, acquisition will almost always be preferable to entry, at least in the symmetric case considered here. Entry by acquisition is thus more likely in mature industries (which are almost in equilibrium with further direct entry still profitable, but relatively unattractive), or in highly concentrated industries ($N \leq 7$ firms).

If firms differ in profitability, then the most attractive firm to acquire would be the lowest cost firm, for which the value $\pi_i^n - \pi_i^{n+1}$ will be the largest. If the entrant has lower costs than the marginal firm, and if the marginal firm is displaced by the entrant upon entry, then the profits of the incumbents will fall upon his entry (because a high cost marginal competitor has been replaced by a lower cost competitor), but not by as much as if no firm were displaced. The first firm in an industry is always an attractive target, as argued above, for monopoly profits are more than twice duopoly profits (provided the assets of the incumbent are transferable to the entrant and the entrant does not have a significant cost advantage over the incumbent). As duopoly profits may be greater or less than twice triopoly profits, the second firm may or may not be a target. When firms differ in costs, (but assets are transferable to an entrant), the value of acquisition relative to direct entry depends on the cost structure of the industry and on the competitive consequences of entry. In general, acquisition can be preferable to direct entry for some values of *n*. However, in the linear Cournot case, the following proposition holds for any distribution of costs.

Proposition 2: In the linear Cournot model of equations (2) and (3) it is always more profitable to acquire rather than enter directly when there is room for no more than one more firm in the industry.

Proof: Define $A \equiv a + \sum_{i=1}^{N-1} m_i$, and consider the left hand side of equation (1). If the entrant's variable costs are m, and there is at least one target with variable costs no higher than m, then the minimum value of the LHS of (1) is

$$\left[\frac{A}{N} - m\right]^2 - \left[\frac{A + m}{N+1} - m\right]^2 = \left[\frac{A-Nm}{N}\right]^2 - \left[\frac{A-Nm}{N+1}\right]^2.$$

The RHS of (1) reaches its highest value when F is lowest, or when $F = \{(A-Nm)/(N+2)\}^2$. As

$$N^{-2} - (N+1)^{-2} > (N+1)^{-2} - (N+2)^{-2},$$

equation (1) is automatically satisfied. QED.

Condition (1) is related to the condition for an incumbent firm to acquire (or merge with) an existing firm derived by Salant, Switzer and Reynolds (1983) (SSR). They found that merger was rarely attractive in the symmetric Nash–Cournot oligopoly – just as we found that in the same case when the free–entry number of firms is large, potential entrants would only prefer to acquire the first firm and the last two or three firms in the industry. Subsequently, Perry and Porter (1985) and Deneckere and Davidson (1985) extended the approach of SSR to other technological and competitive conditions. Deneckere and Davidson demonstrated that merger was more likely to be attractive in an industry with differentiated products and price competition. Acquisition is also likely to be more attractive than entry *de novo* in this case, because product differentiation gives each firm local monopoly power, and, from Proposition 1, acquisition is attractive when the incumbent is a monopoly.

Perry and Porter (1985) object to the model of linear costs. With linear costs, the merged firms are no different than a single firm facing fewer competitors – they derive no benefit from pooling their assets. In Perry and Porter's model firms produce using a scarce factor whose total supply to the industry is fixed and divided amongst firms in some initial allocation. Merger then results in the combined firm having access to more of this scarce factor, which allows it to produce at a lower cost if it reduces its supply. In addition, Perry and Porter parameterized the degree of competition in the industry, which could take any value from perfectly competitive to completely collusive. How would these modifications affect a potential entrant's decision to acquire rather than enter *de novo*?

A potential entrant would increase the total supply of productive capital if it did in fact enter *de novo*, and the threat to do so is important to the acquisition decision. Thus the assumption of a fixed total supply of industry capital is not suitable for analyzing the acquisition decision, even if the acquiring firm adds no productive capability beyond that of the acquired firm. If the potential entrant brings complementary factors into the industry which lower the cost of production or otherwise increase the value of an incumbent, then acquisition is more likely. Varying the degree of competition does effect the acquisition decision in a somewhat similar fashion to mergers between established firms. With Nash–Cournot competition gross industry profits decrease quite rapidly with the number of firms, while with perfect collusion there is no decrease. Acquiring firms is thus cheaper in the Nash–Cournot case, and while the value of direct entry is also lower, the condition for acquisition ($\pi^n - 2\pi^{n+1} > 0$, in the symmetric case) is more likely to be met. Perry and Porter find high levels of collusion are also inimical to merger, for similar reasons.

Finally, if firms vary in their profitability then acquisition is more likely, at least if the acquired firm retains its original cost cost characteristics (or its costs remain below those of the entrant). The firm with the lowest costs will normally be the most profitable firm and will also produce the largest market share. Increasing the degree of competition by entry is thus likely to have a larger impact on its profits than on smaller, less profitable firms, and so it can be acquired relatively more favorably. This conjecture is borne out by simulations.

The upshot is that the symmetric Nash Cournot model is not an extreme case for the analysis of entry — other formulations may lead either to acquisitions being more or less attractive, in ways that are intuitive given the condition of equation (1).

2.1 The Bargaining Problem

Now suppose that the entrant cannot credibly commit himself to enter if the offer is declined. Would the offer ever be accepted? Suppose that the firms differ in their operating costs, with $m_1 < m_2 < m_3$ etc, and suppose that acquiring any of the first $j > 1$ firms at their alternative value π_i^{n+1} would be more attractive than entry *de novo*. If the entrant approaches the first firm with the offer π_1^{n+1} it will be rejected, for the incumbent will reason that it would also be profitable for the entrant to approach one of the other firms, and that if he were to do so, and be successful, then the first firm will continue to enjoy profits π_1^n. If each firm believes this, then none will accept.

The problem facing the entrant is to find an offer which the incumbent will rationally believe would not be offered to other firms, and which if rejected, would lead to entry (or some other outcome less attractive to the incumbent). Several possibilities suggest themselves. One is for the entrant to identify the least attractive member of the first *j* potential targets, and to offer that firm π_j^{n+1}. Firm *j* could reasonably argue as follows: no other firm $i < j$ would accept the offer on the previous argument, and the entrant knows that, so that if I turn down the offer, logically he should enter. Given that he will enter if I turn him down, then I should accept.

This argument is moderately persuasive, but is not a subgame perfect equilibrium in the sense of Selten (1975), for if the *j*th firm were to reject the offer, it would pay the entrant to make the same offer to firm *j* in the next period. Knowing that, firm *j* would do well to reject the offer, as he will earn π_j^n for one period, and then be no worse off than if he had accepted the offer now. The present value of this strategy is greater than that of accepting $\pi_j^{n+1} + \varepsilon$ (per period forever).

In order to construct a sub–game perfect equilibrium there must be some cost to the incumbent of rejecting the offer, which in turn must mean that a repeated offer is less valuable than the initial offer. Rubinstein (1982) proposed a solution to a class of two–person bargaining problems in which the objective was to partition a pie of fixed size and each player preferred to have his piece earlier rather than later. The present problem differs in that although there is a fixed amount to be divided (in this case the difference between the profits before and after entry), there are more than two players, and incumbents benefit from not being involved in the negotiation.

2.2 Costly Bargaining

Suppose that the entrant must pay a one–time cost C in order to make an offer to any firm. It makes an offer of K_i (per period) to firm *i*. If this offer is rejected, the entrant can either enter, approach another firm (upon further expenditure C), or force an aggressive takeover, at a price L_i (per period) plus an additional one–time cost γC to the entrant. If not resisted, the takeover will be successful, and the incumbent will receive L_i, but if the incumbent attempts to delay for one period, it will have to expend D_i in defense. The situation will then be as after the initial rejection.

This game can now be analyzed. The incumbent will accept the offer immediately if

$$K_i > L_i > (\pi_i^n - D_i)(1-\beta) + \beta L_i, \tag{8}$$

or

$$K_i > L_i > \pi_i^n - D_i.$$

(Here β is the discount factor, $1/(1-\beta)$ is the factor converting a constant flow of receipts into a present value, and the present values of the alternatives have been multiplied by $1-\beta$ to give (8)). Reasoning as in Rubinstein (1982), the entrant will make the offer provided it is attractive to do so, even off the equilibrium path; i.e. even if the incumbent rejects the offer this period (but would logically accept it next period). If the incumbent rejects, then the entrant will make an aggressive takeover rather than enter or approach another firm *j* if

$$\pi_e < \pi_i^n - L_i - \gamma(1-\beta)C > \underset{j \neq i}{\text{Max}} \left\{\pi_j^n - K_j - (1-\beta)C\right\}. \tag{9}$$

Finally, the entrant will make the initial offer rather than enter or aggressively take over the target if

$$\pi_i^n - L_i - (1+\gamma)(1-\beta)C < \pi_i^n - K_i - (1-\beta)C > \pi_e.$$

Sufficient conditions for these to be satisfied can be found by replacing *j* with *i* in the right hand inequality of (9) (assuming incumbent *i* was the best takeover candidate in the first place), which gives

$$K_i - L_i > (\gamma-1)(1-\beta)C,$$

which, together with (8) and (9) gives

$$\pi_i^n - D_i < L_i < K_i + (1-\gamma)(1-\beta)C,$$

and

(10) $$D_i - \gamma(1-\beta)C > \pi_e.$$

If (10) is satisfied (which requires that γ be not too large) then values of K_i and L_i can be found which meet all the conditions, and the lowest such value will constitute the offer, which will be immediately accepted. The entrant will approach the firm for which such a K_i can be found, and for which $\pi_i^n - K_i$ is maximal.

It is clear that even if acquisition is potentially profitable (in that condition (1), which translates into (7) for the symmetric Cournot case, is satisfied), there may not be a value of K_i for which acquisition is a sub–game perfect Nash equilibrium, and even if there is such a value, acquisition may not be very profitable. It is also possible that the threat of takeover may allow a target to be acquired at a lower value of K than π^{n+1} if D_i is large, in which case acquisition may be attractive even when (1) is not satisfied. In the interests of keeping the analysis simple, we shall suppose that (1), and hence (7) or its counterpart, are necessary conditions for attractive takeover, and that the bargaining between the entrant and incumbent leads to some division of the potential surplus, $\pi_i^n - \pi_i^{n+1} - \pi_e^{n+1}$, between the entrant and incumbent. In other words we assume that bargaining is not costly (or, rather, that the outcome for the entrant is the same as if bargaining were not costly). Thus if the division is in the proportion $\theta:1-\theta$, the entrant will receive $\pi_e^{n+1} + \theta(\pi_i^n - \pi_i^{n+1} - \pi_e^{n+1})$ and the incumbent will receive $\pi_i^{n+1} + (1-\theta)(\pi_i^n - \pi_i^{n+1} - \pi_e^{n+1})$. *Whether or not acquisition or entry is preferable will depend only on the existence of a surplus and not on* θ and for simplicity we shall assume that $\theta = 1$ in the following.[5] In the Appendix we examine various bargaining games which achieve these outcomes.

3. The effects of shark repellent on entry

The preceding section has shown conditions under which a firm can or cannot ward off an acquisition threat by undertaking costly defense measures after the firm has been targeted for acquisition. Even if *ex post* defense measures are ineffective against an aggressive takeover, established firms may have other means to reduce the likelihood of acquisition. Suppose at a cost of c per period an established firm can institute measures that diminish its value to a potential acquirer *relative to other established firms that have not engaged in ex ante defense.* Such measure might include liberal employee benefits, or a high debt load that increases the cost of acquisition for a cash–constrained acquirer. Alternatively, in the event of a hostile takeover, the value of the company is depleted, perhaps by offering greenmail or by making generous transfers to existing workers conditional on a change of ownership. (Phillips Petroleum provides such an example, see Pickens, 1987). We refer to such measures as shark repellent. Shark repellent can work in two ways. "Strong" shark repellent can succeed against even a determined Great White. In section 2.2, *ex post* measures that defend a firm against an aggressive takeover attempt are examples of "strong" shark repellent. "Weak" repellent will succeed only in motivating the shark to prefer a different lunch, but it will lunch nevertheless. We consider both varieties in what follows.

Consider first the case where each firm can choose *ex ante* to apply strong shark repellent and suppose that firms differ in their profits, and are numbered with the most valuable firm as the first. Suppose that when the size of the industry is *n*, the first *k* firms would be attractive acquisitions, and that for these firms

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[5] A potential entrant would acquire if $\theta(\pi_i^n - \pi_i^{n+1} - \pi_e^{n+1}) + \pi_e^{n+1} > \pi_e^{n+1}$, or if $\pi_i^n - \pi_i^{n+1} > \pi_e^{n+1}$, which is condition (1).

$$\pi_i^n - \pi_i^{n+1} > c.$$

If firms 1, 2, ... , k–1, have chosen to apply (strong) shark repellent, then the *k*th firm will be acquired if it does not apply shark repellent, and entry will occur if it does. In both cases its profits fall to π_k^{n+1}, but in the former case it has had to spend c in addition. Shark repellent is thus unattractive from the point of view of shareholders for the last remaining target, (although not necessarily for managers). Now suppose that firms 1, 2, ... , k–2, have chosen to apply shark repellent. The *k*–1–th firm knows that if it applies shark repellent it will not be acquired, and if it does not, and the *k*th firm does, it will be acquired. Shark repellent is then attractive to the shareholders of the firm, assuming that they do not wish to be bought up at this unattractive price. If, on the other hand, there are *m* firms which are content to be bought up, then the only firms which need to apply shark repellent to avoid acquisition are those whose variable costs are lower than the willing targets. These firms can ensure that they are not bought up by applying shark repellent.

The situation is different with "weak" shark repellent. If firms 1, 2, ... , k–1, have chosen to apply (weak) shark repellent, the *k*th firm will be acquired with probability 1 if it does not apply shark repellent, and with probability p_k if it does. Shareholders of the *k*th firm, if risk–neutral, are better off with shark repellent if

$$\pi_k^n - \pi_k^{n+1} > c/(1-p_k). \tag{11}$$

If the above inequality is satisfied for all *k*, the shareholders of all established firms are better off with shark repellent, although it will be completely ineffective in deterring acquisition. If (11) is not satisfied, shark repellent would not be desired by the shareholders of any firm, in which case the outcome will be the same, but at lower social cost.

Of course the decision to apply shark repellent is vested in the managers of the firms, whose goals need not be consonant with value maximization of the firm. Yet this analysis shows that in many situations the use of shark repellent, even if it does not succeed in preventing a takeover, is nonetheless consistent with the maximization of shareholder wealth.

Will a potential entrant acquire a firm knowing that it may be the object of attention for some future acquirer? Suppose that the entrant acquires firm *k* at a cost of K (per period), and that after T periods the entrant will be re–acquired with probability p_k at the same price. Assume the industry is unchanged over this period of time and into the future, so that K remains the best offer for the next entrant. The entrant will buy if

$$(12) \qquad W = (\pi_k^n - K)(1 + \beta + .. \beta^{T-1}) + \beta^T[p_k K/(1-\beta)+(1-p_k)W] > \pi_e^{n+1}/(1-\beta),$$

or

$$K(1 - \beta^T(1+p_k)) < \pi_k^n(1 - \beta^T) - \pi_e^{n+1}(1-\beta^T(1-p_k)).$$

In the special case in which $\pi_e^{n+1} = \pi_k^{n+1}$ and $K = \pi_k^{n+1}$, this reduces to the same condition as acquiring with no subsequent re–acquisition, equation (1). Thus if it were attractive to acquire the *k*th firm without threat of re–acquisition, it remains attractive to acquire even with the threat of future re–acquisition.

The irrelevance of turnover to the current value of acquisition has important empirical implications. In Porter's (1987) study of entry behavior, he notes that more than half of the acquisitions made by new entrants in an industry are followed by divestiture. He concludes that "(M)y data paint a sobering picture of the success ratio of these moves" (p. 45). Our analysis suggests a different interpretation for the incidence of acquisition and subsequent divestiture. Acquisition can occur because it is less costly than direct entry. If a new entrant acquires and becomes an incumbent firm, it is not unlikely that circumstances will find this firm on the other side of the transaction at a future date. Porter infers from the subsequent sale that the original acquisition was unprofitable. While there are many examples of ill–fated acquisitions, the fact that an acquisition is followed by divestiture does not necessarily imply that the original acquisition was unprofitable or imprudent from the shareholders' point of view.

Porter (1987) also remarks that portfolio management as a corporate strategy is inferior to diversification by shareholders (p. 51). But a firm which is a credible entrant in a target's line of business can improve the terms of acquisition by threatening to enter the target industry as a competitor, a threat that is not available to individual shareholders. Thus the Miller–Modigliani (1958) argument that shareholders can diversify as well as firms does not apply to the case where firms, but not shareholders, have a credible entry threat.

Porter's sobering view of corporate strategy and our analysis of acquisition versus direct entry are consistent in an important respect. Porter concludes that "portfolio" or "conglomerate" acquisitions in which the target firm has little in common with the acquring firm have dim prospects for success. Conglomerate acquisitions are examples of acquisitions in which the acquiring firm has no special expertise in the business of the target firm and therefore the threat of direct entry would be minimal. We would expect that in this case the acquiring firm could not secure advantageous terms in an acquisition as a consequence of its entry threat, and there would be little reason to expect such acquisitions to be profitable.[6]

The sequence of acquisition followed by divestiture raises a curious possibility for the evolution of the industry. If shark repellent does not succeed in preventing acquisition, once acquisition becomes attractive, it will continue to be preferable to direct entry. The paradox of the industry which is attractive to enter but never grows can be avoided by supposing there to be two types of entrants – those with sufficient resources to buy up incumbents, and those which lack such resources, but have sufficient capital to enter and prosper. In such cases the industry will grow anyway, and may pass through configurations in which acquisition is attractive, and then reach a size at which entry is preferable.

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6 The absence of expertise in the target industry implies that π_e^{n+1} is small. If π_e^{n+1} were small but positive, this would make acquisition attractive relative to entry and would be a motivating factor for conglomerate acquisitions. But this is irrelevant if the acquiring firm is not a credible entrant.

4. Multiple entrants and the dynamics of entry

The analysis so far has been restricted to the case of a single entrant. While this is consistent with much of the economic literature on entry and entry deterrence, it is perhaps not surprising that a single entrant can acquire an existing firm on favorable terms. What would happen if there was competition among firms for entry or acquisition? The results in Grossman and Hart (1980) might suggest that this competition would dissipate any potential profits from acquisition, but the following proposition shows that this need not be the case.

Proposition 3: Consider the symmetric case with m target firms and J = m+j simultaneous potential entrants, with j ≥ 1. Then, if

(13) $$\pi_i^{n+j} - \pi_i^{n+j+1} > \pi_e^{n+j+1} > 0,$$

in equilibrium, m potential entrants will acquire the m targets and the remaining j potential competitors will enter directly.

Proof: As in Grossman and Hart (1980), two or more firms competing to acquire the single target will dissipate profits, and so it will be better for one of them to enter if there are positive profits from direct entry. If $\pi_e^{n+j+1} > 0$, then *a fortiori* $\pi_e^{n+j} > 0$ and profits from direct entry are positive when all of the m targets have been acquired and the remaining j potential competitors enter directly. If $j = J-m$ firms enter *de novo*, each of the remaining m potential entrants will choose to acquire (and the other j entrants will be satisfied with direct entry) if and only if (13) is satisfied. QED.

Proposition 3 bears on the observation by Grossman and Hart (1980) that the dominant strategy of individual shareholders is to tender their shares only if the value of the bid fully reflects the increased profitability under new management, and therefore the acquisition will not be profitable if bidding is costly. Although in practice bidders have other means at their disposal to improve the terms of the acquisition (Shleifer and Vishny, 1988, cite the refusal to share gains with non–tendering shareholders and secret accumulation of shares before the tender offer as examples[7]), Proposition 3 shows that acquisition can be profitable even if there is competition (and, by continuity, even if bidding is costly), provided that acquiring firms have the credible option of entering the target industry. Moreover, the profit from acquisition can exceed the profit from direct entry. The key factor in the entry decision is the threat to undermine the profits of the incumbent firm. This threat is robust to the number of bidders for the firm, provided the bidding firms can credibly threaten to enter the industry *de novo*.

In the competition to enter the industry, either by acquisition of by direct entry, the value of acquisition can exceed the value of direct entry even when there are multiple bidders for the acquisition targets. But note that the "winners" in this contest are the firms that enter the industry directly. They earn π_e^{n+j}, while the acquiring firms earn $\pi_e^{n+j} - \pi_i^{n+j+1}$. The decison problem facing each of the *m* acquiring firms is to acquire and earn $\pi_e^{n+j} - \pi_i^{n+j+1}$, or to enter and earn π_e^{n+j+1}. When (13) holds, the acquiring firms make more profit by acquiring than by entering directly, but they earn less than the *j* firms that succeed in entering directly.[8]

The incentive to acquire rather than enter an industry directly depends, *inter alia*, on the structure of the industry and the number of firms that can be acquired. This suggests that as an industry grows, it may pass through phases of entry by acquisition and entry by new investment. Suppose that potential entrants arrive at the rate of one per period. (This implicitly defines the length of the period). Suppose also that *m* firms are potential targets for acquisition in that they do not and will not use shark repellent. This may be because they are content to be acquired, or because it is not worth using shark repellent. An example of the former case might be a firm founded by an entrepreneur with a gift for identifying profitable

7 Saloner (1988) describes a signalling strategy in output by which an acquiring firm can profitably take over a competitor. In his paper a rival signals toughness by output expansion to drive down the acquisition price, whereas in our case the threat of entry drives down the price.

8 The simultaneous entry assumption does not allow competition to emerge to be the first direct entrant, which would tend to dissipate the rents from entry.

opportunities, but no special talent for running a mature business – such a firm would prefer to be bought out on favorable terms and then move on to seek out another profitable opportunity. Finally, suppose that entrants who acquire existing firms will not wish to be acquired and so will apply shark repellent. (This would not apply to the last acquiring firm, which would be targeted by the next entrant. To avoid complications in the proof we shall ignore this difficulty and suppose that all entrants can protect themselves, so that direct entry must occur after the *m* targets have been acquired. One rationalization is that there is exogenous entry at some rate, such that the last target is acquired just before exogenous direct entry moves the industry to long run equilibrium. Other possibilities are discussed below.)

The evolution of the industry can now be described for the symmetric Nash–Cournot example. Suppose the sunk costs of entry are sufficiently small that the free–entry number of firms, N, is large. With a single entrant, it can be shown that if n > 1, direct entry is preferred to acquisition unless n > N–k, where k is no more than 3. With a sequence of entrants, we will show that each period a firm will enter until the total number of firms reaches M ≥ N–k, the first point at which acquisition becomes more attractive than *de novo* entry. The *m* targets will now be acquired, after which direct entry will continue until there are N firms in the industry and further entry is unprofitable. More precisely, we have

Proposition 4: *In the Nash–Cournot symmetric linear case, if there are n > 1 incumbents, m ≥ 1 targets, N > 7, and potential entrants arrive at the rate of one per period, then firms will enter until*

$$\pi^n > 2\pi^{n+1} + \beta W^{n+1}, \tag{14}$$

where

$$W^n = \pi^n + \beta\pi^{n+1} + .. + \beta^{N-n}\pi^N/(1-\beta)$$

is the value of a firm when there are n incumbents and entry will occur at the end of each subsequent period. At this value of n, all targets will be acquired in sequence, after which *entry will continue until the industry is in long run equilibrium.*

Proof: The first step is to find the smallest value of n (the number of firms currently in the industry) such that if there were only one remaining target, then that target would be acquired. Let this number be M. Acquisition will be preferable to entry in this case if (14) holds, and does not hold when n is replaced by M−1.

Next, suppose that (14) is satisfied, so that if there were M firms in the industry, the last target would be acquired. We shall argue that if there are m targets and M firms, the next entrant will acquire if the following m−1 entrants also acquire. The value of acquisition for the first of these m successful acquirers is

$$V^a = \frac{1-\beta^m}{1-\beta}\pi^M + \beta^m W^{M+1} - V^e$$

where the first two terms are the present value of an acquired incumbent and V^e is the present value of entering, which is also the incumbent's value if the entry threat is exercised. Now

$$V^e = \frac{1-\beta^m}{1-\beta}\pi^{M+1} + \beta^m W^{M+1}$$

so the value of acquiring less the value of entering for the first of the m successful acquirers is

$$\frac{1-\beta^m}{1-\beta}\pi^M + \beta^m W^{M+1} - 2\left\{\frac{1-\beta^m}{1-\beta}\pi^{M+1} + \beta^m W^{M+1}\right\},$$

which has the same sign as

$$(1-\beta^m)(\pi^M - 2\pi^{M+1}) - (1-\beta)\beta^m W^{M+1}.$$

But if (14) holds for n = M, then this is positive, and so acquisition will be preferable to entry. Thus if the industry contains M firms, all remaining targets will be acquired.

The next step is to show that if there are $m > 1$ targets, and if the number of firms is less than M, it will not be attractive to acquire rather than enter. Suppose, in contradiction, that it were profitable to acquire when there are M–1 firms in the industry, given that the next entrant will enter *de novo*, and the following $m-1$ entrants will acquire (which, by the previous argument, is what will happen once the number of firms reaches M). For acquisition followed by entry to be profitable, then reasoning as above, the following two conditions must hold:

$$\pi^{M-1} - 2\pi^{M} > \beta\left\{\frac{1-\beta^{m-1}}{1-\beta}\right\}\pi^{M} + \beta^{m}W^{M},$$

$$\pi^{M-1} - 2\pi^{M} < \beta\left\{\frac{1-\beta^{m-2}}{1-\beta}\right\}\pi^{M} + \beta^{m-1}W^{M}.$$

It will be impossible to satisfy these two conditions if

$$\pi^{M} > W^{M}(1-\beta).$$

It remains to be established that this is ensured for all relevant cases. Since, from the Corollary below, $M \geq N - 3$ for $N > 7$, there are only two cases to check, and this is readily done.

It must also hold that if direct entry is preferred for n = M–k, .., M–1 (with the remaining targets acquired at n = M), then acquisition cannot be preferred in the preceding entry period. To show this, let n = M–k, and define V(n,m) as the value of an incumbent firm when there are *n* incumbents and *m* remaining targets. By assumption, direct entry is preferred at (n,m), so that

$$V^e = \pi^{n+1} + \beta V(n+1,m)$$

exceeds

$$V^a = \pi^n + \beta V(n,m-1) - V^e,$$

or

$$\pi^n - 2\pi^{n+1} < \beta\{2V(n+1,m) - V(n,m-1)\}.$$

If acquisition is preferred at (n, m+1),

$$\pi^n - 2\pi^{n+1} > \beta\{2V(n+1,m+1) - V(n,m)\}.$$

These conditions cannot be satisfied if

$$2\{V(n+1,m+1) - V(n+1,m)\} - \{V(n,m) - V(n,m-1)\} \geq 0.$$

But this is just

$$\beta^{k-1}(2-\beta)\pi^M > 0.$$

Finally, it must not be the case that potential entrant *j* would prefer to delay entry or acquisition until some future date. Suppose firm *j* would have entered along the path described in Proposition 4. According to Proposition 3, the best the firm could do in the future is to enter directly, but then it is no better off, and it gives up positive profits it would have earned by entering immediately. If firm *j* would have acquired, by delaying it faces the same industry configuration (*n* incumbents and *m* targets) at a future date and it gives up positive profits in the interim. Thus again delay could not be profitable. QED.

Corollary: With sequential entry, acquisition will not occur for a smaller industry than in the *static case of the single entrant, and may occur later, if at all.*

Condition (14) ensures that the static entry condition (1) is satisfied for the symmetric case, i.e $\pi^n > 2\pi^{n+1}$, though for suitable values of β, π^N it may not be possible to satisfy (14) for n = N−1, in which case entry will continue until the industry reaches equilibrium at n = N.

There is one other sequence, in the somewhat improbable case in which all entrants are potential acquiring firms. (As acquisition requires large initial financial reserves, or the credit worthiness to be able to guarantee a flow of future payments, not all entering firms will be in a position to acquire). We have seen that it never pays all potential targets to apply shark repellent (if to do so is costly), in which case once entry by acquisition starts at n = M, the acquiring firms will in due course themselves be acquired, and the industry will never increase beyond M firms. More plausibly, direct entry by firms unable to finance an acquisition will gradually shift the industry to its long run equilibrium size. If such firms arrive every *m* periods, then direct entry will continue until n = M (possibly now a different value than before), at which point acquisition will continue until one of these exogenous direct entrant arrives, after which, if n < N, acquisition will again continue until a direct entrant arrives, and so on until n = N.

5. Conclusions

Mergers and takeovers may occur for a variety of reasons, though the standard explanation is either executive hegemony or that the acquiring firm expects to put the target firm's assets to more productive use and can therefore bid more for the firm than its current value (at least, until the bid becomes public, at which point the price may rise to its expected future value, as pointed out by Grossman and Hart, 1980). This explanation has always co–existed rather uncomfortably with the empirical evidence which finds little evidence that the joint profitability of the target and acquiring firm rise after merger. (See, e.g. Jarrell et al, 1988). Our explanation is rather different — it may be profitable to acquire a firm even if there is no improvement in its profitability (and, by continuity, even if there is an increase in its operating costs and a decline in its profitability). The reason is that it may be more profitable to acquire than to enter *de novo*, and the threat of entry may allow the acquiring firm to buy up the target at below its previous value. If the entering firm can bring complementary assets or expertise, or lower the operating costs of the target, the acquisition will be more attractive than entry *de novo* for a wider range of cases than those identified here.

Our theory has a number of attractive features. It explains why entry might occur by acquisition in some cases, and *de novo* in others. Acquisition is relatively more likely in small concentrated industries, in industries in which firms coexist with a wide range of unit costs, and in nearly mature industries. Thus, depending on industry structure and the technology of existing and potential competitors, there is a preferred path of entry into an industry, which may take the form of either new investment or acquisition of existing corporate assets. The analysis of entry with multiple targets also explains why firms may or may not use shark repellent. Each potential target would rather another firm were acquired (assuming that it does not wish to sell out in order to realize its asset value), and would be willing to forego some profits in order to lower the chance of takeover to zero. However, shark repellent will not repel the sharks, for it only pays firms to protect themselves if entry is successfully prevented and acquisition actually occurs, and for that at least one firm must be unprotected. Shark repellent is thus a social loss, ineffective but costly. Moreover, from the social point of view, entry is socially desirable (at least in this simple model with no second best R&D public good problems), so even if successful, shark repellent would be undesirable. Shark repellent is, however, attractive to the shareholders of the potential targets in our model, and its application need not be explained by resort to theories of managerial preference.

For most of the paper we employed a simple model of Nash Cournot oligopolistic competition, though it seems clear that the results will generalize to other forms of oligopoly. The condition for acquisition, rather than entry *de novo*, given in equation (1) (or its dynamic equivalent) will hold for all such theories — the differences will arise in the determination of the profit levels before and after entry. The more successfully the incumbent firms can collude to avoid dissipating total industry profits, the smaller is likely to be the fall in profits upon entry, and hence the less attractive acquisition will be relative to entry *de novo*. Conversely, the more vigorously competition increases with the number of firms, the greater the incentive to acquire rather than enter.

The economic literature on entry and entry deterrence has generally ignored the value of acquisition as an alternative path by which to gain a foothold in an industry. The literature on corporate finance has generally ignored the value of direct entry as an alternative to a takeover attempt. Our paper argues that acquisition and direct entry should not be considered in isolation, and that their consideration as alternative strategies allows insights into the theory of corporate strategy and finance.

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Appendix

Offers with the threat of random entry

In the first version of the game, the entrant identifies the incumbent currently enjoying the largest surplus relative to the profits it would earn were the entrant to enter *de novo*. The entrant offers the incumbent $K/(1-\beta)$ for his firm, where β is the discount factor (so the sum is equivalent to a stream of payments of K per period for ever). If the offer is accepted, the game ends with the transfer of the firm to the entrant, but if it is rejected, the entrant decides, with probability p,[9] to enter the next period, and with probability 1–p to reoffer the same package {K, p}. The game is repeated indefinitely until either the incumbent accepts or the entrant enters. We assume that the entrant can commit to entry with probability p if the incumbent rejects the offer.

The incumbent compares the benefits of accepting and rejecting. If it accepts it receives $K/(1-\beta)$. If it rejects, then it will enjoy its current profits π^n for one period (where superscript *n* indicates the number of firms in the industry), and next period it will either experience entry, after which its profits will be π^{n+1}, or it will return to the same initial state. Let the value of rejecting be W, then W is given by

$$W = \pi^n + \beta\left\{p\frac{\pi^{n+1}}{1-\beta} + (1-p)W\right\}, \tag{A1}$$

or

$$W = \frac{\pi^n + \beta p \pi^{n+1}/(1-\beta)}{1 - \beta(1-p)}.$$

The incumbent will accept the offer provided

9 The randomizing device should be verifiable and non–manipulable. It should not be difficult to construct such a device – e.g. enter if the outcome of a public lottery draw of eight successive random digits is greater than 72000000.

(A2) $$K > \frac{(1-\beta)\pi^{n}+\beta p\pi^{n+1}}{1-\beta(1-p)} \equiv \underline{K}(p).$$

The entrant will be willing to repeat the offer once more in the expectation that it will be accepted the second time provided this condition is satisfied (so that the incumbent has the incentive to accept) and provided it is worth repeating the offer, that is, provided

(A3) $$\pi_e < \beta\{p\pi_e + (1-p)(\pi^n - K)\}.$$

Here π_e is the flow rate of profits to the entrant if he enters, so the left–hand side is the value per period of entering immediately, the first term on the right–hand side is the value upon entering in response to randomizing, and the second is the value of acquiring the firm at a cost K per period and then enjoying profits π^n. The condition on K is

(A4) $$K < \pi^n - \left\{\frac{1-\beta p}{\beta(1-p)}\right\}\pi_e \equiv \bar{K}(p).$$

Provided $\beta < 1$, $\underline{K}(0) > \bar{K}(0)$ and $\underline{K}(1) > \bar{K}(1)$, so the inequalities can be satisfied, if at all, only for interior values of p: $0 < p_1 \leq p \leq p_2 < 1$, where p_i are the roots of the quadratic formed by $\bar{K}(p) = \underline{K}(p)$:

(A5) $$p^2 - p + \frac{\lambda(1-\beta)}{\beta^2(1-\lambda)},$$

where

$$\lambda \equiv \frac{\pi_e}{\pi^n - \pi^{n+1}}.$$

This will have a solution provided $\lambda < \{\beta/(2-\beta)\}^2$. If there is no solution, then the entrant cannot make a credible offer, and will immediately enter. Figure 1 shows the feasible area within which the contract {K, p} must lie bounded by the two curves $\bar{K}(p)$ and $\underline{K}(p)$. The entrant wishes to minimize the entry cost, K, and so, since $\underline{K}(p)$ is decreasing in p, it will choose the maximum value of p subject to satisfying both inequalities. From the figure this is clearly the larger root:

$$p_2 = \frac{1 + \sqrt{1 - \frac{4\lambda(1-\beta)}{\beta^2(1-\lambda)}}}{2}.$$

As $p_2 < 1$, $K(p_2) > \underline{K}(1) = (1-\beta)\pi^n + \beta\pi^{n+1} > \pi^{n+1}$, which is the value of the incumbent if entry took place, and the lowest price at which acquisition might be thought possible. The fact that the entrant cannot credibly threaten an all–or–nothing offer to acquire or enter thus raises the cost of acquisition.

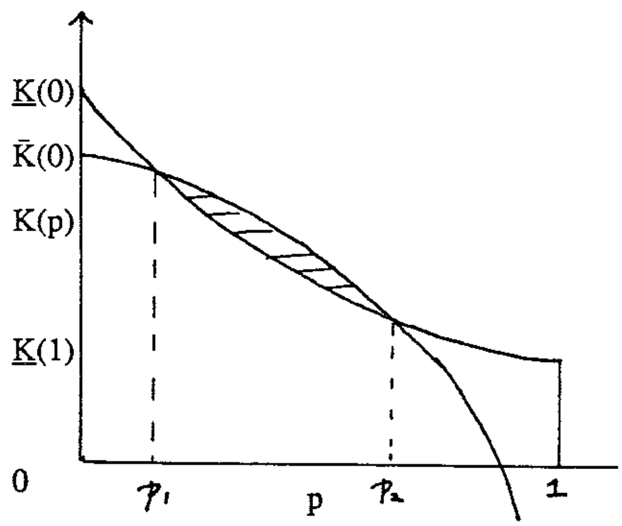

Figure 1 Feasible Offers

Numerical example

Consider the model of equations (1) and (2), where the variable cost of the *i*th firm is m_i. Now suppose that $m_1 = 2$, $m_2 = m_e = 3$, $n = 2$, $a = 10$, $F_i = 1.5$, and $\beta = 3/4$. Then $\pi_1^2 = 7.5$; $\pi_1^3 = 4.75$; $\pi_2^2 = 2.5$; $\pi_2^3 = 0.75 = \pi_e$. $\lambda = 3/11$, $p_2 = 0.789$, $K = 5.565$. The acquisition cost is thus higher than the alternative value of the firm after entry of 4.75, though it is below the

Nash bargaining solution in which the entrant and incumbent equalize the excess over their threat point values. In this case the incumbent makes 0.815 more than he would if entry occurs, whilst the entrant makes 1.185 more than if he were to enter: the gains are divided 60:40 between the entrant and incumbent.

Accelerating the renegotiation

Suppose that the entrant can speed up the process of renegotiation, so that if his offer is not accepted, then he can immediately make his random entry decision, and return to renew his offer assuming he has not entered. What effect does this have on the equilibrium? Suppose that the entrant can repeat the offer after a period of time Δ, then equation (A2) becomes

(A2')
$$K > \frac{(1-\beta)\Delta\pi^{n}+\beta^{\Delta}p\pi^{n+1}}{1-\beta^{\Delta}(1-p)} \equiv \underline{K}(p, \Delta),$$

whilst (A4) becomes

(A4')
$$K < \pi^{n} - \left\{\frac{1-\beta^{\Delta}p}{\beta^{\Delta}(1-p)}\right\}\pi_{e} \equiv \bar{K}(p, \Delta).$$

Then

$$\lim_{\Delta\to 0} \underline{K}(p, \Delta) = \pi^{n+1}, \quad \lim_{\Delta\to 0} \bar{K}(p, \Delta) = \pi^{n} - \pi_{e},$$

so that K is set at $\pi^{n+1} < \pi^{n} - \pi_{e}$. Rapid renegotiation thus benefits the entrant by lowering the cost of acquisition to is minimum value.

Offers and Counteroffers

The game in which the entrant makes an offer to the incumbent which he either accepts or rejects might seem to given undue advantage to the entrant, who is able to choose an offer which is the lowest that is just be acceptable. Suppose instead that the incumbent can reply with a counteroffer M (per period for ever, i.e. $M/(1-\beta)$ as a capital sum), which the entrant can either accept, or repeat his initial offer $\{K, p\}$. The sequence of moves is now as follows. The entrant offers $\{K, p\}$, which the incumbent can either accept, or reject with a counteroffer M. In the event of a counteroffer, the entrant randomizes to decide whether to enter (with probability p), or to consider the counteroffer. If the counteroffer is more attractive than the predicted outcome of the repeated offer $\{K, p\}$, then the entrant accepts M and the game ends. If not, the entrant makes the counteroffer and the game repeats.

The counteroffer is attractive to the entrant if

(A6) $$\pi^n - M > \beta\{p\pi_e + (1-p)(\pi^n - K)\},$$

i.e

$$M < \pi^n\{1 - \beta(1-p)\} + \beta\{(1-p)K - p\pi_e\}.$$

The incumbent will counteroffer if

(A7) $$K < (1-\beta)\pi^n + \beta\{p\pi^{n+1} + (1-p)M\}$$

i.e

$$M > \frac{K - (1-\beta)\pi^n - \beta p\pi^{n+1}}{\beta(1-p)}.$$

The incumbent will accept the entrant's offer and not counteroffer if both inequalities are reversed, i.e. if

(A8) $$K\{1-\beta^2(1-p)^2\} > \{1-\beta+\beta(1-p)(1-\beta+\beta p)\}\pi^n + \beta p\pi^{n+1} - \beta^2(1-p)p\pi_e.$$

This provides an additional constraint on p, as equation (A8) can be written $K = K^*(p)$. Moreover, $\underline{K}(0) = K^*(0)$ and $\underline{K}(1) = K^*(1)$, but for $0 < p < 1$, $K^*(p) > \underline{K}(p)$, as shown in Figure 2, and so the best offer that the entrant can be made is $\bar{K}(p_2)$ where p_2 is the larger of the two roots of the quadratic equation $\bar{K}(p) - K^*(p) = 0$. Thus in the numerical example given above, $\{K,p\} = \{5.876, 0.7198\}$. The gains from agreeing rather than allowing entry are now divided between the entrant and the incumbent in the ratio 44:56, and the ability to counteroffer has improved the position of the incumbent.

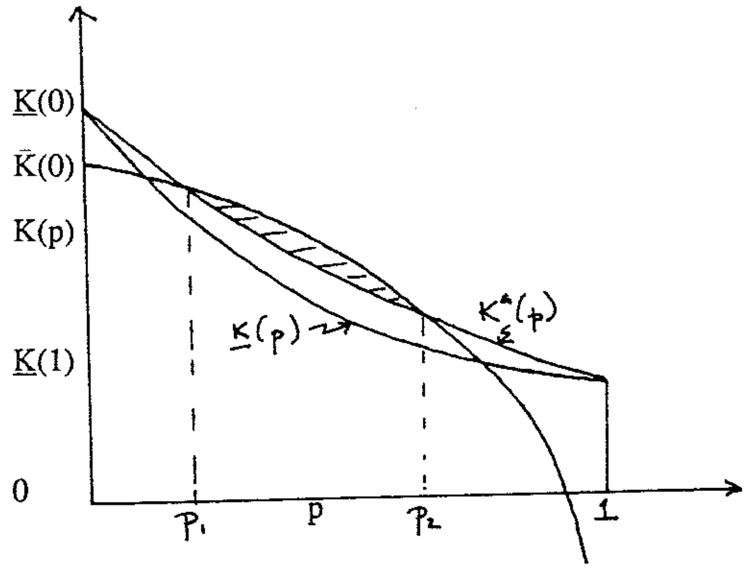

Figure 2 Feasible Offers and Counteroffers

If the period of renegotiation shrinks as before then it is easy to check that $K \to \pi^{n+1}$ and $p \to 1$. Allowing the incumbent to make counteroffers (provided he is forced to respond quickly) does not improve his position in the limit.

The main problem with these formulations of the bargaining problem is that while the solutions are a Nash equilibria they are not subgame perfect. An alternative formulation for the static single entrant case which is subgame perfect is the following.[10] The entrant makes an offer of K. If this is rejected, then no firm will accept any offer from this entrant for τ periods,

10 We owe this suggestion to Drew Fudenberg.

but at that future date the offer can be repeated and the game starts again. The period τ is such that $\beta^{\tau}(\pi^{n} - K) < \pi_{e}^{n+1} < \beta^{\tau-1}(\pi^{n} - K)$. The entrant will thus enter *de novo* if his original offer is rejected, and if he fails to enter, he will wait and start afresh with the same offer. Knowing this, the incumbent would indeed reject any offers which arrived before τ periods had elapsed, thereby continuing to enjoy current profits. Since the entrant would rationally enter if rejected, the incumbent will not reject the original offer (assuming $K > \pi^{n+1}$). In particular the entrant can make an offer arbitrarily close to π^{n+1}, as assumed in the text.

In the non–stationary game with subsequent entry the value of τ in the strategy will depend on the current and anticipated future state of the industry, but for any such specification there will be a value of τ to support the equilibrium.

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