WORKING
PAPERS

JUDO ECONOMICS, ENTRANT ADVANTAGES, AND TEH GREAT AIRLINE COUPON WARS

Judith R. Gelman (Federal Trade Commission)

Steven C. Salop (Georgetown University Law Center)

WORKING PAPER NO. 58

June 1982

BUREAU OF ECONOMICS
FEDERAL TRADE COMMISSION
WASHINGTON, DC 20580

Revised: May 10, 1982

JUDO ECONOMICS, ENTRANT ADVANTAGES, AND THE GREAT AIRLINE COUPON WARS

Judith R. Gelman (Federal Trade Commission)[1]
Steven C. Salop (Georgetown University Law Center)

I. INTRODUCTION

This paper explores the role of precommitment strategies in the strategic interaction between a dominant firm and a fringe competitor. These elements are examined in a model in which a fringe competitor partially offsets a demand disadvantage by a strategy of capacity limitation and discount pricing.

By simultaneously precommitting itself to remaining small and setting a low price for its output, a fringe competitor can both reduce the threat it poses to the dominant firm and make retaliation expensive. Thus, by using a low-price/low-capacity strategy, an entrant can induce an incumbent to accommodate its entry. To capture the image of a small firm using its rival's large size to its own advantage in this way, we call this a strategy of judo economics.

---

[1] The opinions in this paper do not necessarily represent the views of the Federal Trade Commission. We would like to especially thank Elizabeth Bailey, Avinash Dixit, William Dudley, Joe Farrell, Bob Frank, David K. Levine, Steve Salant, Dick Schmalensee, David Scheffman, Warren Schwartz, Carl Shapiro, and Mike Spence for helpful conversations.

The paper is organized as follows. Section II sets out the basic elements of the simplest capacity-limitation model. In this first model, a fringe competitor (entrant) with unlimited capacity and no efficiency advantage is deterred by the (rationally based) prospect that its entry will not be accommodated. The role of strategic capacity limitation in preventing retaliation is then explored. We show that if the entrant judiciously limits its capacity, a dominant firm (incumbent) finds it more profitable to accommodate the entrant than to retaliate. The model is generalized in Section III to the case of continuous product-differentiation and product-design strategies.

Section IV examines a more sophisticated entry strategy. When the entrant limits its capacity and sets a low price, it must ration its scarce output among excess willing customers. This allows the entrant an opportunity to increase its profits by selling transferable rights to that scarce, low-priced capacity. We call this a couponing strategy. As shown in that section, if the entrant's coupons are transferable and if the incumbent has a cost advantage over the entrant, then it is in the incumbent's self-interest to honor the coupons and serve coupon holders at a discount. When this occurs, the entrant produces no output but rather earns its profits solely from the sale of its coupons. Section V discusses the recent experience in the airline industry and elsewhere in light of this analysis. The Conclusion reviews the results of the model and suggests a number of extensions.

II. CAPACITY AND COMPETITION

Consider the following industry. Consumer demand for a product class is given by the demand function D(p). Initially the market is served by an incumbent monopolist with unlimited capacity to produce output at a constant marginal cost c_1. We denote the incumbent's initial (monopoly) price as p_{1m}.

Suppose now that a single potential entrant appears.[2] Suppose the entrant can produce up to k units of the product at a constant marginal cost of c_2. The entrant can select its level of capacity k costlessly. The entrant must also sink a nominal cost of (say) $1 if it enters.[3]

The entrant's prospects depend on consumers' relative demands for the two brands and the type of strategic interaction that occurs after entry. In this paper, we wish to focus on the effects of the entrant's commitments to limited capacity on the post-entry pricing game. To highlight these issues, we first assume a special form for relative demands--a lexicographic preference for the incumbent's brand at equal prices.

Assume that at identical prices, all consumers prefer the incumbent's brand; with any price differential, all consumers

---

2 We use the terms entrant and fringe interchangeably. Multiple entrants, discussed briefly in the conclusion, are beyond the scope of this paper.

3 This nominal sunk cost serves to prevent entry unless price strictly exceeds the entrant's marginal cost. Presumably, the incumbent has already sunk this cost.

prefer the less expensive brand. We call this a lexicographic preference advantage. Formally, let demands x_1 and x_2 for incumbent and entrant respectively be given as follows:

$$(1) \qquad x_1 = \begin{cases} D(p_1) & \text{if } p_1 \le p_2 \\ 0 & \text{otherwise} \end{cases}$$

$$x_2 = \begin{cases} 0 & \text{if } p_1 \le p_2 \\ D(p_2) & \text{otherwise} \end{cases}$$

This demand specification has been chosen primarily for its convenience. The qualitative results of the model do not depend crucially on this special form, which is generalized in Section III(B) below. However, it should be noted that the lexicographic preference advantage may have independent interest; in some airline markets, consumers appear to prefer the largest carrier in this way.[4]

We make the following assumptions about the rivals' strategic interaction. Suppose the entrant has the ability to choose irrevocably a price/capacity pair (p_2, k) upon entry, to which the incumbent must react with a price choice p_1. Thus, the entrant is the Stackelberg price "leader" and the incumbent is the price "follower," in standard Industrial Organization usage. Moreover,

---

4 See Schmalensee (1982) for an alternative specification of the advantage of first entry in terms of the first entrant as the "pioneer" brand.

we assume that the incumbent may not discriminate but must charge p_1 to all potential customers. It is possible that the entrant's ability to precommit to a capacity limit gives it an advantageous position despite the draconian assumption that consumers lexicographically prefer the incumbent's brand. This position is possibly advantageous, because there are no general theorems concerning the advantages of order of play.[5] Moreover, as the following analysis demonstrates, any actual benefit of the entrant's first-move position depends crucially on its ability to credibly limit its capacity.[6] If the entrant can only choose its price but not precommit to a limited capacity, it is placed at a clear disadvantage.[7] To see this result, we first consider the case in which the entrant's capacity k is assumed to be unlimited.

A. Competition With Unlimited Capacity

If the entrant's capacity is unlimited, it only chooses a price p_2. Because the nominal entry cost must be paid, entry is only profitable if the fringe entrant chooses a price above its marginal cost c_2. But, if the entrant has no cost advantage

---

5 For example, see Schelling (1960) and Guasch-Weiss (1980).

6 Compare Spence (1977).

7 Under certain circumstances, it may be difficult for the entrant to credibly precommit itself to a limited capacity. Additions to capacity might be added secretly, or additional output might be purchased from subcontractors. As discussed below in Section III(B), the entrant might increase the credibility of its commitment by designing a product with only limited appeal.

($c_2 > c_1$), the incumbent surely maximizes its profits by matching or undercutting the entrant's price. If the entrant sets $p_2 > p_{1m}$, the incumbent earns greater profits by undercutting and setting $p_1 = p_{1m}$. If the entrant sets $c_2 < p_2 < p_{1m}$, the incumbent earns greater profits by matching ($p_1 = p_2$) than by undercutting ($p_1 < p_2$). This is due to consumers' lexicographic preferences; at any price $p_1 > p_2$ the incumbent obtains no customers, whereas at equal or smaller prices ($p_1 < p_2$) the incumbent obtains the entire market demand $D(p_1)$, as given by equation (1).

Because the incumbent always matches or undercuts the entrant's price, the entrant obtains no customers at any $p_2 > c_2$. Marginal-cost pricing $p_2 = c_2$ is unprofitable because the nominal entry cost must be paid.[8] Thus, entry does not occur unless the entrant is strictly more efficient.[9] What may not be obvious is the importance of the entrant's unlimited capacity and the incumbent's inability to price discriminate in generating these results. It is to these issues that we now turn.

---

8 Alternatively, if we were to assume that entry only occurs if strictly positive profits can be earned, the same zero-entry result obtains.

9 A post-entry competition based on the Bertrand equilibrium--i.e., a Nash-in-price equilibrium--is more complicated, but the results are qualitatively similar. Without capacity limitations, the Bertrand equilibrium also implies zero entry. When brands are differentiated, these strong results do not obtain. See Section III(B) below.

B. Competition With Capacity Limitations

By judiciously precommitting itself to a limited capacity, a less efficient entrant may make itself less threatening to the incumbent and therefore improve its strategic position. As a result of the entrant's limiting its size, the incumbent is not forced to match the entrant's price. Instead, the incumbent can permit the entrant to sell out its limited capacity at a low price and can retain for itself the remainder of the market at a higher price. The entrant's capacity limitation may thus be viewed as an example of strategic precommitment. (See Schelling [1960].)

We formalize this strategic precommitment as follows. Suppose the entrant irrevocably chooses some price/capacity pair (p_2, k). The incumbent subsequently responds by choosing a price p_1. The incumbent has two basic choices--$p_1 > p_2$ (accommodating) or $p_1 < p_2$ (undercutting or matching).

Under certain circumstances, it may be possible for the incumbent to adopt a third choice of selective matching--that is, it may offer discounts to only those customers approached by the entrant. However, such a price-discrimination strategy requires an ability to distinguish the entrant's actual or potential customers from all others.[10] In addition, even if the incumbent

---

[10] Of course, if the entrant offers the low price to all consumers satisfying some objective criterion (say, by using a screening device), then the incumbent can selectively match the entrant's offer by using the same criterion. Similarly, exchange of customer lists allows selective matching, as do meet-or-release and meeting-competition contractual clauses that require buyers to notify the incumbent of discount offers.

could identify and attract consumers who are about to purchase output from the entrant, that would not reduce the total amount of discount output available from the entrant if entry has already occurred and capacity has already been chosen. That is, if the incumbent matches the entrant's price for one customer, the entrant will attempt to sell its discount output to another customer. Selective matching is facilitated, of course, if the entrant sells coupons, as discussed in section IV below. For now, however, we assume that selective matching is impossible.[11]

Assuming that selective matching is impossible, the entrant obtains no customers in the event that the incumbent matches or retaliates. A profit-maximizing entrant thus chooses among the (p_2, k) pairs that induce an accommodation response. To derive this set of entry-accommodation pairs, we first turn to the incumbent's problem.

When the incumbent matches ($p_1 = p_2$) or undercuts ($p_1 < p_2$), it obtains all the customers. If the entrant chooses $p_2 > p_{1m}$ (the initial monopoly price), the incumbent will surely undercut by setting $p_1 = p_{1m}$. At any price $p_2 < p_{1m}$, the incumbent clearly

---

[11] Certain clauses in long-term contracts may credibly prohibit or require selective matching. A most-favored-nation clause guarantees the buyer that it will be extended and discounts the manufacturer offers. If the incumbent provides all buyers with such a clause, selective matching is made impossible. See FTC In the Matter of Ethyl Corp. et al., Initial Decision, August 5, 1981. In contrast, a meeting-competition clause requires the incumbent to selectively match. In both these cases, the threat of court-enforced damages provides credibility. As a result, they are powerful tools for entry deterrence or collusion under certain structural conditions.

finds matching more profitable than undercutting.[12] Because the incumbent always undercuts if the entrant picks $p_2 > p_{1m}$, no entrant will pick $p_2 > p_{1m}$; undercutting does not occur otherwise. Therefore, in calculating the entry-accommodation pairs, we can ignore the undercutting ($p_1 < p_2$) strategy.

For any price p_2, if the incumbent matches, it earns profits $\Pi_M(p_2)$ given by

$$(2) \qquad \Pi_M(p_2) = (p_2 - c_1)D(p_2) \qquad \text{for } p_1 = p_2.$$

Alternatively, the incumbent can accommodate the entrant by choosing $p_1 > p_2$ and allowing the entrant to sell out its k units. At $p_2 < p_1$, the entrant must ration (the rights to) its scarce output on some nonprice basis.[13]

Two simple rationing schemes are uniform rationing and reservation-price rationing. Under uniform rationing, the rights are distributed randomly among consumers willing to pay at least price p_2.[14] This random selection of consumers is probably the more realistic of the two schemes. Alternatively, under reservation-price rationing the k customers with the highest

---

[12] This result assumes that the profit function $\Pi(p) = (p-c)D(p)$ is strictly concave.

[13] We put off for now the question of the exact nonprice mechanism by which these rationing schemes are carried out.

[14] Of course, if the rights were transferable, then an aftermarket for these rights could exist and rights could have resale value. If so, even consumers with lower reservation prices would desire them.

reservation prices are given the rights to the entrant's product.[15] Of course, they must be selected on some nonprice basis.[16] As shown in Section IV below, selling the rights by means of transferable coupons induces exactly this latter type of rationing. This rationing scheme is also quite simple to analyze, making it a good introduction to the method of analysis used throughout this paper. Thus, we take it up first and study uniform rationing in the subsequent section. For now, we also assume that the rights are not transferable. Thus, no aftermarket can exist.

Assuming that the entrant employs a rationing device by which the k customers with the highest willingness to pay obtain its output, the incumbent's residual demand equals $D(p_1) - k$, if it accommodates by choosing $p_1 > p_2$. Its maximized profits are therefore given by

$$\Pi_A(k) = \max_{p_1} (p_1 - c_1)[D(p_1) - k] \tag{3}$$

where the profit-maximizing entry-accommodating price is denoted by

---

15 Rationing to consumers with the lowest reservation prices gives the entrant the strongest position, since it damages the incumbent the least. Analysis of this case and the entrant's choice of an optimal rationing scheme are beyond the scope of this paper, however.

16 If the high-reservation-price customers are identified by using price (i.e., if the entrant offers its units at a price p_1), the incumbent will match.

(4) $p_1 = p_1(k), \qquad p_1'(k) < 0.$

The derivation of $p_1(k)$ is illustrated in Figure 1 below.[17]

Differentiating equation (3), the profit-maximizing entry-accommodating price $p_1(k)$ satisfies the first-order condition

(5) $(p_1 - c_1)D'(p_1) + D(p_1) - k = 0.$

Totally differentiating equation (5), it is clear that $p_1'(k) < 0$ as long as the profit function is strictly concave.

Because the entrant only obtains sales when the incumbent responds by accommodating, the profit-maximizing entrant chooses a (p_2, k) pair such that the incumbent earns greater profits by accommodating than by matching, or

(6) $\Pi_A(k) \geq \Pi_M(p_2).$

Note that equation (6) reflects the convention that if the incumbent is indifferent between the two strategies, it chooses to accommodate.

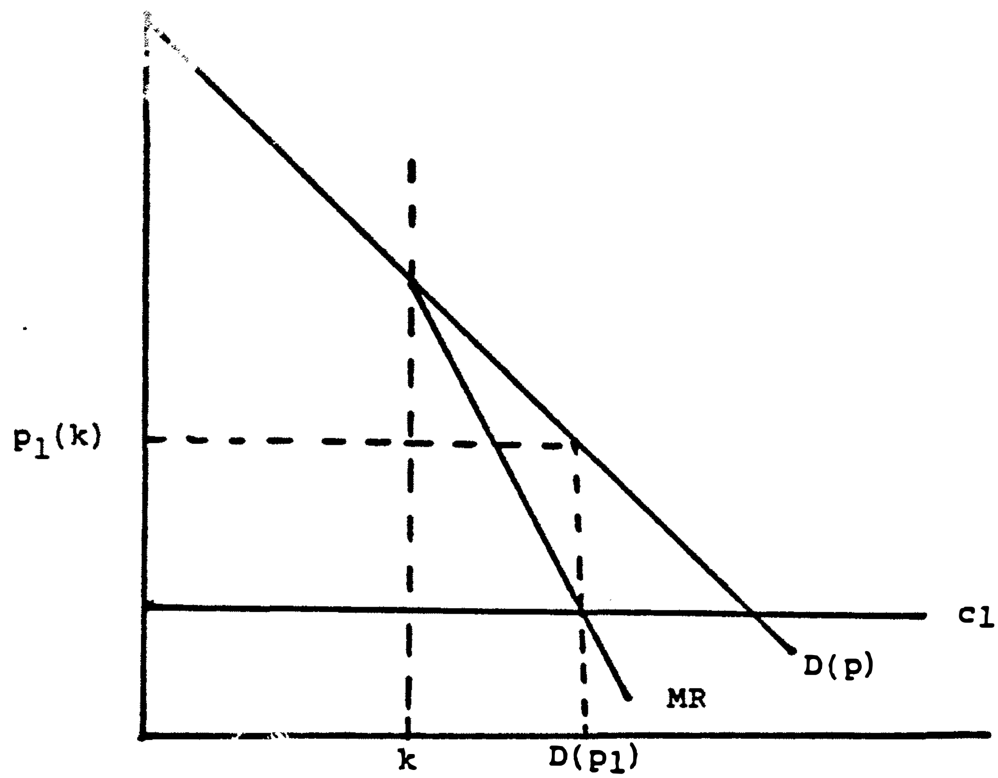
It must also be shown that all (p_2, k) satisfying equation (6) has the entrant charging a lower price than the incumbent, or

(7) $p_2 < p_1(k).$

---

17 Note that $p_1(0) = p_{1m}$, the monopoly price.

FIGURE 1



INCUMBENT'S PROBLEM

Equation (7) is indeed satisfied for all k in the relevant open interval $(0, D[c_1])$.[18]

We denote the set of (p_2, k) pairs that satisfy equation (6) with equality as $\phi(k)$ so that the accommodation set is given by

$$p_2 \le \phi(k). \tag{8}$$

Thus, the frontier $\phi(k)$ represents the entrant's demand curve.[19] As long as the entrant chooses a price/capacity pair along $\phi(k)$,[20] the incumbent will accommodate its entry and the entrant can sell its entire capacity k. The $p_1(k)$ function and the (p_2, k) accommodation set are illustrated in Figure 2 below. The shaded area in Figure 2 represents all (p_2, k) pairs within the accommodation set.

We may now solve for the entrant's optimal strategy as follows. Writing the optimality problem, we have

---

[18] We prove this result as follows. Consider a (p_2, k) that satisfies equation (6). Substituting from equations (2), (3), and (4) into equation (6), we have

$$(p_1(k) - c_1)D(p_1[k]) - (p_2 - c_1)D(p_2) \ge k(p_1[k] - c_1) > 0.$$

Since the profit function $\Pi(p)$ is concave, $p_2 \le p_{1m}$ and $p_1(k) < p_{1m}$, then the inequality implies equation (7).

[19] Setting an equality in (6), the slope of the demand curve is given by $\phi'(k) = -(p_1 - c_1)/[(p_2 - c_1)D'(p_2) + D(p_2)] < 0$ for $p_2 < p_{1m}$.

[20] Or just inside the $\phi(k)$ curve, if we were to adopt the alternative convention that the incumbent only accommodates when that strategy strictly dominates matching.

(9) $$\Pi_2 = \max_{p_2, k} \; (p_2 - c_2)k$$

$$\text{s.t. } p_2 \leq \phi(k).$$

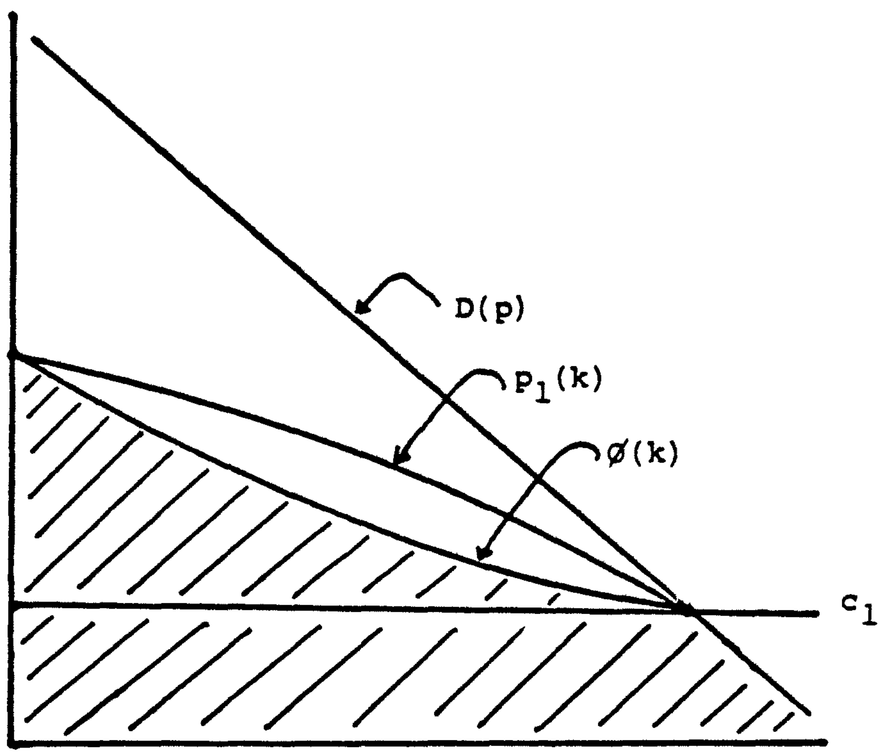
At the optimum, the constraint holds with equality. Substituting the constraint into the entrant's profit function and differentiating, we have the first-order condition that defines optimal capacity k^*.

(10) $$\phi'(k^*)k^* + \phi(k^*) - c_2 = 0.$$

This in turn defines the entrant's optimal price $p_2^* = \phi(k^*)$ and the incumbent's best response $p_1^* = p_1(k^*)$. These values are illustrated in Figure 3 below.

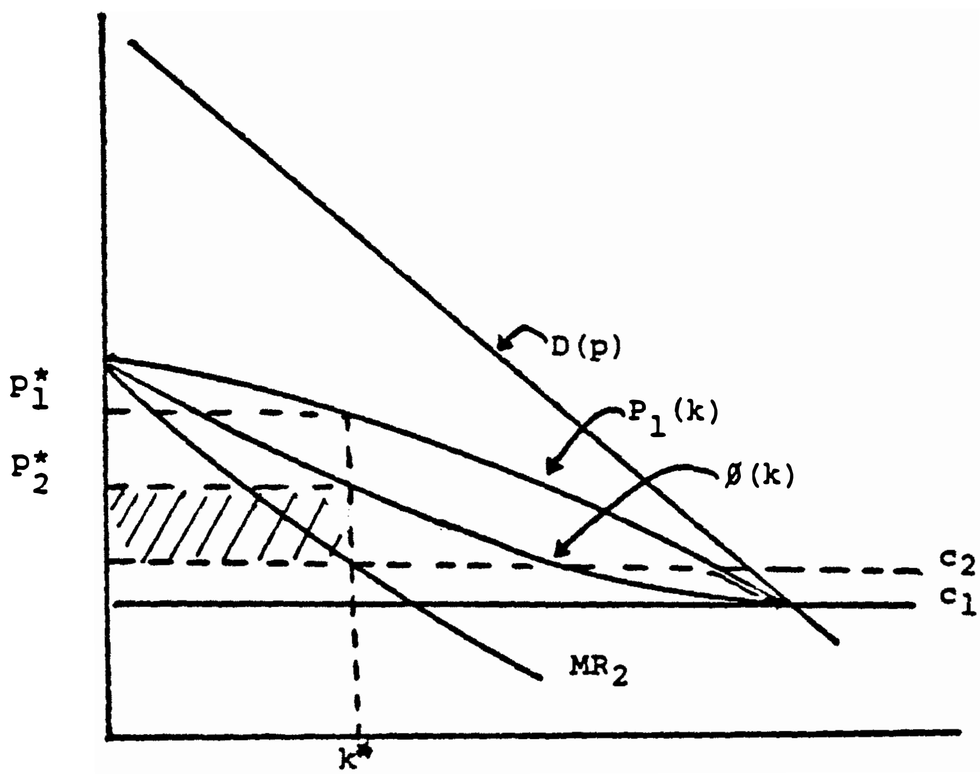
When the incumbent accommodates the entrant, it lowers its price below its initial monopoly price p_{1m} ($p_1[k^*] < p_{1m}$). However, the incumbent does not match the entrant's price. Rather, it maintains an "umbrella" under which the entrant can prosper, as long as it remains satisfied with its modest share. The benefit to the entrant of limiting its capacity is now apparent. By precommitting itself to remaining small, the entrant provides credible assurance that its low-price strategy will not damage the incumbent too severely. Similarly, by choosing a low price, the entrant makes matching or undercutting more costly. Thus, the entrant contrives a situation in which accommodation is the incumbent's best response strategy.

FIGURE 2



ACCOMMODATION SET

FIGURE 3



PROFIT-MAXIMIZATION

This model is thus an alternative formalization of the interaction between a dominant firm and a fringe competitor.[21] Unlike the usual model in which the supply curve of the fringe is taken as exogenous, the fringe entrant in this analysis chooses its supply (marginal-cost) curve. In the model presented here, the entrant's choice is restricted to marginal costs that are constant (at c_2) up to a maximum (capacity) level k. More generally, in a putty-clay model, one could expand the entrant's strategy space to a family of cost functions.

Even given our one-entrant assumption, this formalization captures some features of incumbent/fringe interaction absent in the usual model. These features have been discussed informally in the literature, though they are more prominent in the antitrust oral tradition. For example, Scherer (1980) observes that in many industries, the fringe firms choose to remain small rather than risk retaliation by the dominant firm.[22] This model incorporates these concepts of discipline and punishment. If the entrant were to increase capacity slightly beyond its optimal (p_2^*, k^*) pair on the $\phi(k)$ frontier, the incumbent would cut its price discretely from $p_1(k^*)$ to p_2^*. This punishes the upstart by driving its sales to zero. The entrant may only recover its profits by obeying industry "discipline" and reestablishing a low capacity.

---

21 Here, the fringe is the single entrant. The analysis of entry by a second firm is beyond the scope of this paper.

22 See p. 233.

III. GENERALIZATIONS

The basic model discussed so far represents a special case in a number of dimensions. First, the entrant's scarce output is rationed to those consumers with the highest reservation prices. Second, consumers are assumed to have a lexicographic preference for the incumbent's product. In this section, we relax these two assumptions. We also discuss the generalization to an oligopolistic industry.

A. Uniform Rationing

Up until now we have assumed that the consumers with the highest reservation prices obtain the entrant's scarce output. In the absence of transferable rights and an aftermarket, it is difficult to see why this class of consumers would necessarily obtain the product.[23] As an alternative, we now consider the case in which nontransferable rights to the scarce output are distributed randomly among the willing purchasers.

Let the density of consumers' reservation prices be given by h(w). Total demand is thus the integral of this density, or

$$D(p) = \int_p^\infty h(w)dw. \tag{11}$$

---

[23] The entrant could, of course, employ a screening device that selected the consumers with the highest reservation prices. However, as discussed previously, using such a device makes it easier for the incumbent to match selectively.

Suppose the entrant chooses a price/capacity pair (p_2, k) that the incumbent chooses to accommodate with a higher price $p_1 > p_2$. Each of the $D(p_2)$ consumers (with reservation prices at least equal to p_2) desires the entrant's k units of scarce output. Under uniform rationing, the rights to the k units are apportioned as follows. Let r be the proportion of consumers served at each reservation price, where r is defined according to

$$(12) \qquad k = \int_{p_2}^{\infty} rh(w)dw.$$

Substituting equation (11) into (12) and rewriting, we have the rationing function $r(p_2, k)$,

$$(13) \qquad r = r(p_2, k) = \frac{k}{D(p_2)}.$$

When the entrant's units are rationed to k lucky customers in this way, the incumbent is left with a residual demand of disappointed customers Q^1 who constitute a fraction (1-r) of the market, or

$$(14) \qquad Q^1 = (1-r) \int_{p_1}^{\infty} h(w)dw.$$

Substituting equation (11) into (14), we have

$$(15) \qquad Q^1 = (1-r)D(p_1).$$

We may now solve for the incumbent's optimal accommodation strategy. Its profits are given by

$$(16) \qquad \max_{p_1} \Pi_A = (p_1 - c_1)(1-r)D(p_1).$$

Differentiating (16), we have the first-order condition

$$(17) \qquad (1-r)[(p_1 - c_1)D'(p_1) + D(p_1)] = 0.$$

Inspecting equation (17), it is obvious that the accommodation price is invariant with respect to the entrant's (p_2, k) choice.[24] In fact, the accommodation price equals the (pre-entry) monopoly price, or

$$(18) \qquad p_1 = p_{1m}.$$

Defining the incumbent's maximum accommodation profits by $\Pi_A(p_2, k)$, we have

$$(19) \qquad \Pi_A(p_2, k) = [1-r(p_2, k)](p_{1m} - c_1)D(p_{1m}).$$

Of course, the incumbent still has the choice between accommodation and matching. Following equation (6), we define the <u>accommodation set</u> as the (p_2, k) pairs such that $\Pi_A > \Pi_M$; upon rewriting, we have

---

24 This result depends on the constant marginal-cost assumption.

(20) $(1-r)\Pi(p_{1m}) > \Pi(p_2)$

where

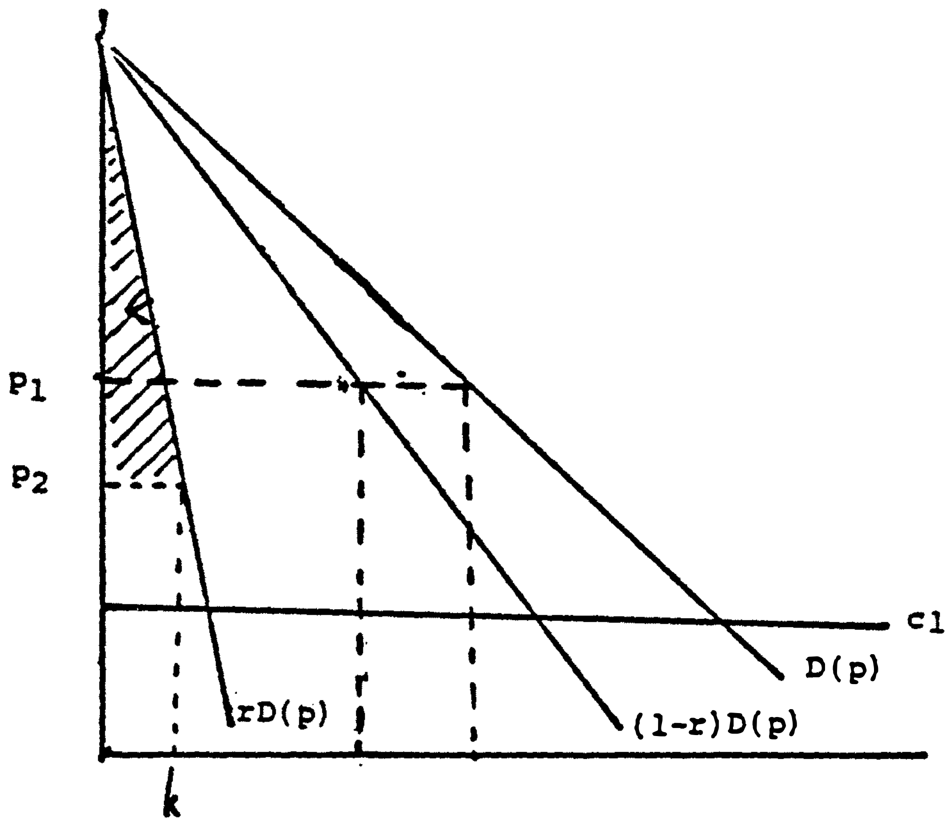
(21) $\Pi(p_i) = (p_i - c_i)D(p_i) \qquad i = 1m, 2.$

As before, equation (20) can be inverted to form an accommodation demand curve of the form $p_2 < \phi_u(k)$, and the entrant's optimal strategy can be calculated as in equation (10). The uniform rationing case is illustrated in Figures 4 and 5 below.

This uniform rationing case captures an often-asserted feature of dominant-firm behavior. As long as the fringe (entrant) stays within the accommodation set, the incumbent does not respond at all, but continues to price at the monopoly level. Only if the fringe (mistakenly?) violates the accommodation set does the incumbent respond. When the punishment comes, it is discontinuous and extreme--the incumbent matches the entrant's price and captures all its customers.

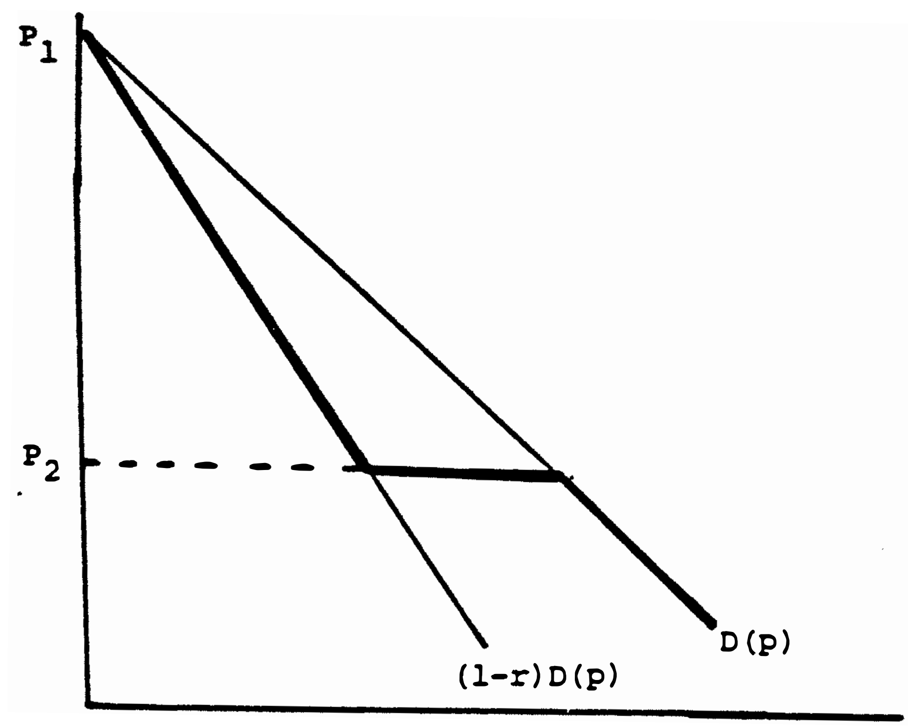
This uniform rationing analysis is only relevant when black or white aftermarkets for the scarce rights to the entrant's output are impossible. When aftermarkets arise, as they might when the entrant distributes transferable rights to its output, rationing by reservation prices reappears naturally. We take this up in Section IV below.

FIGURE 4



UNIFORM RATIONING

FIGURE 5



INCUMBENT DEMAND CURVE (UNIFORM RATIONING)

B. Differentiated Products and Strategic Product Design

We have assumed so far that all consumers have a lexicographic preference for the incumbent's product. As discussed earlier, this specification is a limiting case of demands for differentiated products. In this section, we analyze the strategic roles of capacity limitations and product design in a more general model of differentiated products.

Suppose that the incumbent (firm 1) and the entrant (firm 2) produce differentiated brands in a product class. Formally, suppose consumer demands for the two brands are given by the continuous functions

(22) $$x_i = D^i(p_1, p_2) \qquad i = 1, 2.$$

We assume that demands are not perfectly (in)elastic and that the two brands are substitutes,[25] or

(23) $$\frac{dD^i}{dp_j} < 0 \qquad i = j$$

(24) $$\frac{dD^i}{dp_j} \text{ (23b) } > 0 \qquad i \neq j.$$

[25] The case of complementary products is beyond the scope of our analysis here.

Repeating the earlier analysis, suppose the entrant irrevocably chooses a price/capacity pair (p_2, k) to which the incumbent responds with a price p_1. If these selections (p_1, p_2, k) lead to excess demand for the entrant's product (i.e., if $D^2(p_1, p_2) > k$), the entrant's scarce output must be rationed. Suppose this rationing is carried out on a random basis (uniform rationing) as discussed in the previous subsection. Letting r denote the proportion of the entrant's willing customers to be served by the entrant, we have

$$(25)\quad r = \min \left(\frac{k}{D^2(p_1, p_2)}, 1\right)$$

Assuming that the incumbent obtains all the entrant's excess demand as well as all those customers who prefer its brand,[26] the incumbent's total demand Q^1 is given by

$$(26)\qquad Q^1 = D^1(p_1, p_2) + (1-r)D^2(p_1, p_2).$$

Substituting equation (25) into (26), we have

$$(27)\quad Q^1 = D^1(p_1, p_2) + \max\ [D^2(p_1, p_2)-k, 0].$$

---

[26] This represents the implicit assumption that all of the entrant's disappointed customers prefer the incumbent's brand to none of the product at all. If not, equations (26) and (27) must be altered appropriately.

The incumbent's demand curve is illustrated below in Figure 6 for a particular pair (p_2, k). We denote by p_1^* the "zero excess demand" price (i.e., $D^2(p_1^*, p_2) = k$). Since the brands are substitutes, there is excess demand for the entrant's product at prices above p_1^*, as illustrated in the left panel. This increases the incumbent's demand above its nominal level $D^1(p_1, p_2)$ when it charges a high price, as illustrated in the right panel. The capacity limitation also introduces a "reverse" kink[27] at the zero excess demand price p_1^*.

The analysis now proceeds in a straightforward fashion. Given (p_2, k), the incumbent chooses a price p_1 to maximize its profits, or

(28) $$\Pi^1(p_2, k) = \max_{p_1} (p_1 - c_1)Q^1$$

where Q^1 is given by equation (27).

Maximizing equation (28) with respect to p_1, we may solve for the incumbent's best response function,[28] or

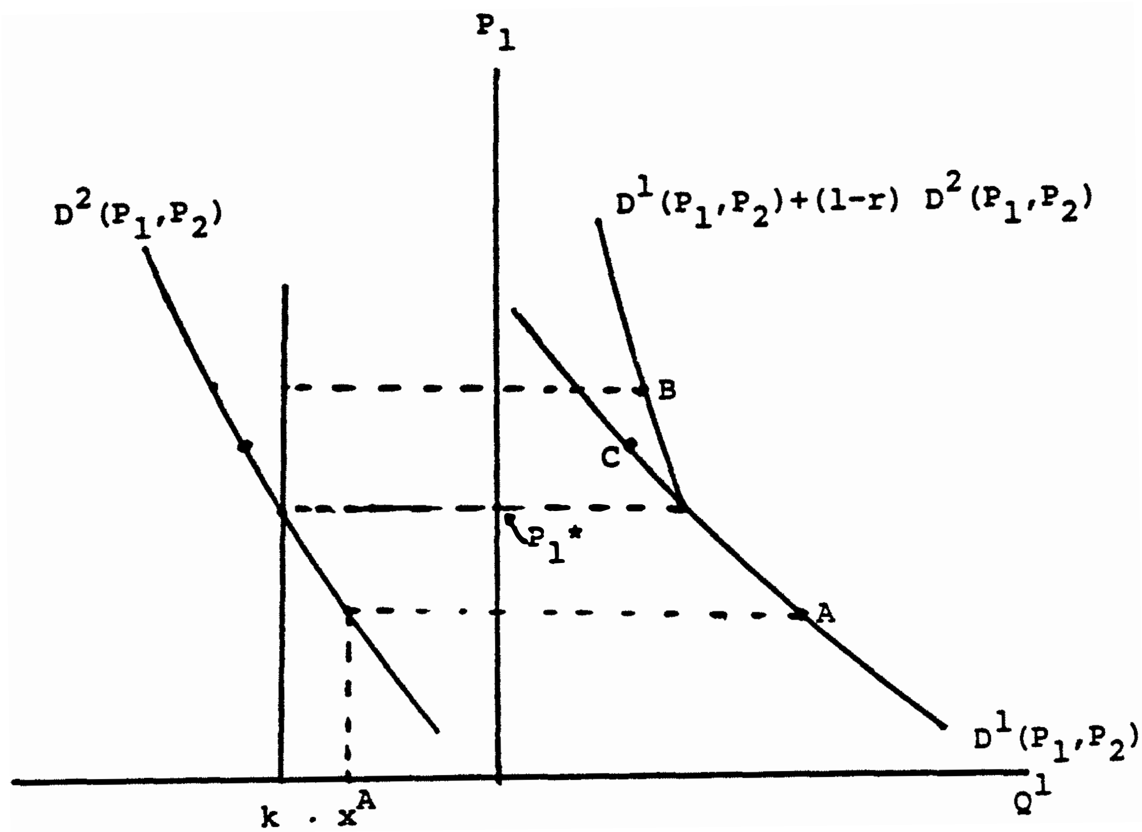
(29) $$p_1 = p_1(k, p_2).$$

---

27 "Reverse" relative to the standard Sweezy-Hitch kinked-oligopoly-demand curve.

28 For the high-price region where $p_1 > p_1^*$, equation (29) is a transformation of $(p_1 - c_1)\ [D^1{}_1 + D^2{}_1] + D^1 + D^2 + 0$. For the low-price region where $p_1 \leq p_1^*$, equation (29) is a transformation of $(p_1 - c_1)\ D^1{}_1 + D^1 = 0$; this latter equation is analogous to the matching response, because capacity is not scarce in this region.

FIGURE 6



DIFFERENTIATED PRODUCTS

Substituting equation (29) into equation (22), we have the entrant's "effective demand," analogous to the $p_2 = \phi(k)$ equation defined earlier, or

$$(30) \qquad Q^2 = D^2(p_1[k, p_2], p_2) = \phi(k, p_2).$$

By creating the kink in the incumbent's demand curve, the entrant can induce the incumbent to raise its price response p_1 from below the kink to above the kink; this is illustrated in Figure 6 as a change from point A to point B,[29] where point A is analogous to a matching response and point B to an accommodation response.[30] In this way, the entrant's sales rise from x^A to k, as illustrated in the left panel.[31]

Thus, the analytic methods used in the earlier lexicographic-preference model generalize to a more standard differentiated-products context. The lexicographic-preference model is more

---

29 A price change (induced by a capacity limitation) from one point above the kink (like point C) to another (like point B) decreases the entrant's sales as shown. Thus, it would not be profit maximizing.

30 In equation (28), the analogy to matching is setting the optimal price for unbounded values of capacity k.

31 It is easy to confirm that capacity limitation is profitable as follows. Denote the entrant's sales in equilibrium as $D^2(p_1, p_2) = k^o$, where (p_1, p_2) are the equilibrium prices. Suppose now that the entrant restricts its capacity to k^o. Given (p_2, k^o), this introduces a reverse kink into the incumbent's demand curve at p_1. As such, p_1 can no longer be profit maximizing. The incumbent's best response must be to raise price. This increases the entrant's quantity demanded, allowing it to raise price and thus profits.

stylized, of course, and the matching and accommodation responses have more literal meanings. However, the qualitative results are basically unchanged. Because the lexicographic model is simpler to work with, we will use it in the discussion of coupon competition that follows.

Product differentiation also has independent interest as an alternative to the capacity-limitation strategy. A brand with only a limited demand does not represent a serious threat to the incumbent. Thus, a more accommodative response is called for. Given this, the entrant might restrict its impact by designing a less desired brand, rather than by directly limiting its (productive) capacity for a more highly desired brand.[32] In short, the entrant must limit its capacity to compete, and product design and capacity design may be used as alternative or complementary paths for achieving this limitation.

Product design may be a superior approach. First, limiting productive capacity may entail significant losses in efficiency. Second, limiting demand by product design may represent a more credible promise of the entrant's cooperative intentions. In some industries, productive capacity may easily be expanded secretly. In others, where additional output can be produced with divisible, variable inputs, credibility is difficult to ensure. In contrast, the product-design decision is often indivisible and entails a

---

32 For an example, see D'Aspremont et al. (1979).

commitment that is costly to alter. A new design might require retooling, a new advertising campaign or trademark, or other sunk costs.[33]

C. Oligopoly Equilibrium

In each of the formal models considered so far, an entrant or fringe firm induces an incumbent firm to accommodate its entry. In this section, we generalize the analytic framework to the case of oligopoly interaction.

Consider the standard cartel model.[34] Beginning from the joint-profit point, each cartel member has a strong incentive to chisel on the cartel price by secretly offering selective discounts. If other cartelists detect this chiseling, they retaliate, leading to a breakdown of the cartel and a mutually less profitable price, at least until the cartel is able to reestablish itself. When uncertainty and stochastic demand are made explicit in these models, there is an information-based relationship between the scope of price discounts and the likelihood of retaliation. The more customers that are offered secret discounts, the greater is the probability that discounts will be detected by rivals, and thus, that retaliation will

---

[33] For models of brand positioning in product space, see Schmalensee (1978), Salop (1979), and the references cited therein.

[34] For the classic exposition, see Stigler (1964). See Green and Porter (1981) for a recent formalization.

ensue.[35] On the other hand, if discounting is kept at a minimal level, detection is less likely and cartel stability is increased.

In this analysis, it is generally assumed that once the secret discounts are detected, retribution is sure and swift. Of course, retaliation may not in fact be the profit-maximizing response for the other members of industry. Accommodating the discounts may be superior to spreading them throughout the market by matching with a general price cut. That is, threats to retaliate may not be credible, and the equilibrium may not be "perfect" (in the sense of Selten).

The lexicographic-preference model may be generalized and reinterpreted as a model of perfect (or credible) sells its product in equilibrium as follows. Suppose an oligopoly sells its product in two independent (or geographically separated) markets. All consumers in geographic market 1 have a lexicographic preference for firm 1, whereas all consumers in geographic market 2 prefer firm 2 lexicographically. Following our previous analysis, let firm 2 act as the fringe entrant in geographic market 1, offering a discount price to a limited number of firm 1's regular customers. In market 2, let the positions be reversed; firm 1 plays the fringe and firm 2 the incumbent.

---

35 In this framework, a most-favored-nation clause makes detection more likely, because discounts must be extented to all customers, not just a few. This gives customers an incentive to uncover discounts and automatically punishes the cheater when detection occurs.

If the two firms have identical costs and the two geographic markets have identical demand characteristics, then a symmetric oligopoly equilibrium obtains as follows. Each firm sells output to its regular customers in its respective submarket at a list price p and offers a discount price p_d to k customers in the geographic market in which its rival is dominant. The equilibrium has the property that neither firm wishes to increase its discounting activities in its rival's geographic market for fear of being matched. At the same time, at equilibrium neither rival wishes to match, given the equilibrium discounts (p_d, k) offered by its (fringe) competitor in its own submarket. Thus, our previous analysis of the strategic interaction between incumbent and fringe extends exactly.[36]

The leader/follower (perfect) equilibrium analysis does not extend so exactly for symmetric oligopolies selling two differentiated products which are perceived as substituted by consumers. Unlike the geographic market case or the lexicographic-preference case, demand for the two products is now continuously interdependent. Firm 1's list-price choice on product 1 affects firm 2's accommodation versus matching tradeoff in product 2. As a result, the chiseling decisions on the two products are not separable. Instead, a conventional Nash equilibrium may be the more appropriate equilibrium concept, where the strategy space for each

---

[36] The equilibrium values, in terms of the notation of section II, are $p = p_1(k^*)$, $p_d = p_2{}^*$, and $k = k^*$.

firm is the triple consisting of a list price, discount price, and discount quantity. Alternatively, a price leader must be chosen arbitrarily or derived from more basic principles not discussed so far. We now take up the issue of aftermarkets and their relationship to coupon competition.

IV. TRANSFERABLE RIGHTS AND COUPON COMPETITION

We return now to the incumbent/fringe framework. So far, we have assumed that the entrant rations its scarce output by distributing (on an unspecified nonprice basis) nontransferable rights to purchase its output. In this section, we analyze the case of transferable rights and its natural extension--coupon competition.

As a starting point, suppose that (as in the uniform rationing case) the entrant randomly distributes rights to its output. However, assume now that these rights are transferable from one consumer to another.[37] Each transferable right thus represents an option to purchase one unit of the entrant's output at the "strike price" p_2.[38] If the incumbent accommodates entry by choosing $p_1 > p_2$, the rights have value to all consumers with reservation prices above p_2.

---

37 A seller can prevent the rights from being transferred by maintaining a registry of rights holders and requiring identification when the output is purchased.

38 The term "strike price" refers to the additional amount a rights-holding consumer must pay to exercise his option and purchase output from the entrant.

The rights have the greatest value to those $D(p_1)$ consumers with reservation prices above the incumbent's price p_1, because without a right those consumers would otherwise purchase from the incumbent. In choosing a seller, these consumers compare the "full price" of the entrant's output $(q + p_2)$ to the incumbent's price p_1, where we denote the transfer price of rights by q. Given their lexicographic preferences for the incumbent's product, these consumers will demand rights only if[39]

(31) $q < p_1 - p_2$.

At any q satisfying equation (31), all consumers with sufficiently high reservation prices prefer the entrant's brand. Thus, the quantity of rights demanded equals $D(p_1)$. If there is excess demand for the rights when equation (31) holds (i.e., if $D[p_1] > k$), the equilibrium price of the k coupons must be infinitesimally less than the price differential $p_1 - p_2$, or

(32) $q = p_1 - p_2 - e$,

where e denotes the infinitesimal.

Noting for completeness the logical possibility of $p_1 < p_2$, we have

(33) $q = \max (0, p_1 - p_2 - e)$.

---

39 If $q > p_1 - p_2$, these consumers strictly prefer the incumbent's product. Thus, there is no demand for rights to the entrant's product.

When $p_1 > p_2$, all the rights to the entrant's k units are ultimately purchased by consumers with reservation prices no less than p_1. These high-reservation-price consumers obtain the entrant's output, leaving the incumbent with a residual demand given by

$$(34) \qquad Q^1 = D(p_1) - k.$$

This is identical to the incumbent's residual demand in the case of reservation-price rationing discussed in Section II(B) above. This result is not surprising; if an aftermarket exists, rights are ultimately transferred to high-reservation-price consumers, regardless of the initial allocation.

If the entrant allocates scarce transferable rights on a nonprice basis, those k fortunate individuals who initially obtain the rights gain a profit q on each right. If, instead, the entrant sells the rights, it obtains additional revenue from the sale.[40] By selling rights, the entrant also effectuates the reservation-price-rationing residual demand curve for the incumbent. Finally, and most importantly, if rights are distributed separately from output and are transferable, the incumbent may choose to honor the rights and serve the bearers at the strike price p_2. We refer to rights with this property as coupons. We

40 The timing of this sale is crucial. In order for the market for these rights to equilibrate as assumed, the output prices p_1 and p_2 must already be known when the sale occurs.

refer to the incumbent's strategy of honoring the coupons by serving the bearers at the strike price p_2 as <u>selective matching</u>.[41]

If the entrant sells the rights to its output, its optimal strategy may change for two reasons. First, it receives additional revenue for every unit sold. Second, if the incumbent honors the coupons, the incumbent's optimal response to a given (p_2, k) pair may change. This, in turn, may affect the entrant's optimal (p_2, k) choice.

In this section, we analyze the case in which the entrant sells coupons that can be honored by the incumbent. First, we derive the incumbent's optimal response function, given that the entrant issues coupons. We then derive the entrant's optimal (p_2, k) choice, assuming that it issues coupons. Finally, we analyze the relative profitability of issuing coupons.

Not surprisingly, we show that the entrant earns greater profits from selling the rights to its scarce low-priced output. We also show that a less efficient entrant prefers issuing coupons (which the incumbent may honor) to selling rights in another form. In addition, we show that a less efficient entrant ($c_2 > c_1$) always sets the strike price p_2 high enough to induce the incumbent to match selectively by honoring the coupons.

---

41 The entrant may prevent selective matching in a number of ways. First, the entrant can prevent the incumbent from identifying coupon holders by keeping a secret registry of customers entitled to the low-priced output. Second, the entrant can replace lost (or honored) coupons, thereby maintaining its output sales at k. We assume throughout that the entrant can precommit itself to limiting its output of coupons to the original k units.

A. <u>The Incumbent's Problem</u>

Up to now, we have assumed that the incumbent does not selectively match the entrant's price. If the entrant issues coupons, however, the incumbent may selectively match the entrant's price by honoring the k coupons at the price p_2 and setting a discriminatory higher price p_1 on sales to its remaining $D(p_1) - k$ customers. Under this <u>selective matching</u> strategy (denoted by the subscript S), the incumbent maximizes profits as follows.

$$(35) \qquad \Pi_{1S} = \max_{p_1} \; (p_1 - c_1)[D(p_1) - k] + (p_2 - c_1)k$$

Differentiating with respect to p_1, it is easy to confirm that the first-order condition is identical to that of the accommodation strategy, as given by equation (5). Hence, for any k, the accommodating incumbent chooses the same p_1 regardless of whether he honors the coupons or not.

To derive the incumbent's optimal response function, we now compare its profits from (i) selective matching, (ii) accommodating, and (iii) matching. As long as the incumbent can earn profits by selling to the coupon holders, it would of course rather serve these customers. Formally, comparing equations (35) and (3), the incumbent earns greater profits from selectively incumbent earns greater profits from selectively matching than matching than from accommodating the entrant if and only if[42]

[42] For convenience, we assume that if the incumbent is indifferent between these two strategies, he honors the coupons.

(36) $$p_2 > c_1.$$

If equation (36) is satisfied, the incumbent also compares (a) matching the entrant's price, selling to all consumers at $p_1 < p_2$ and earning profits Π_{1M}, as given by equation (2), to (b) selectively matching the entrant's price for coupon holders, charging a premium price $p_1 > p_2$ to non-coupon-holders and earning profits Π_{1S}, given by equation (35).[43]

Note that whether the incumbent generally matches the entrant's price or selectively matches the price (for coupon holders only), the incumbent serves the entrant's k potential customers at the strike price p_2. We denote the profits from serving these k coupon-holding customers as Π_{1C}, or

(37) $$\Pi_{1C} = (p_2 - c_1)k.$$

Subtracting Π_{1C} from equations (2) and (35), we have that $\Pi_{1S} > \Pi_{1M}$ if and only if

(38) $$(p_1 - c_1)(D(p_1) - k) > (p_2 - c_1)(D(p_2) - k).$$

Recalling that $p_1(k)$ maximizes $\Pi(p_1) = (p_1 - c_1)[D(p_1) - k]$, equation (38) is satisfied for all (p_2, k) such that $p_1(k) > p_2$.

---

43 We can restrict our inquiry to the region where $p_1 > p_2$. The incumbent cannot discriminate against coupon holders by charging $p_1 < p_2$, because coupon holders cannot be induced to reveal their identity unless $p_1 > p_2$. In addition, by the concavity of $[\Pi(p) = (p - c)D(p),]$ we have $\Pi_{1M} > \Pi_{1S}$ for all $(p_1(k), p_2, k)$ such that $p_{1m} > p_2 > p_1$. Thus, we need not consider the case of $p_1 < p_2$.

Figure 7 illustrates the (p_2, k) pairs for which the incumbent's optimal response is undercutting (U), matching (M), selectively matching to coupon holders (S), and accommodating (A). We now turn to the derivation of the entrant's optimal strategy, given that it issues coupons.

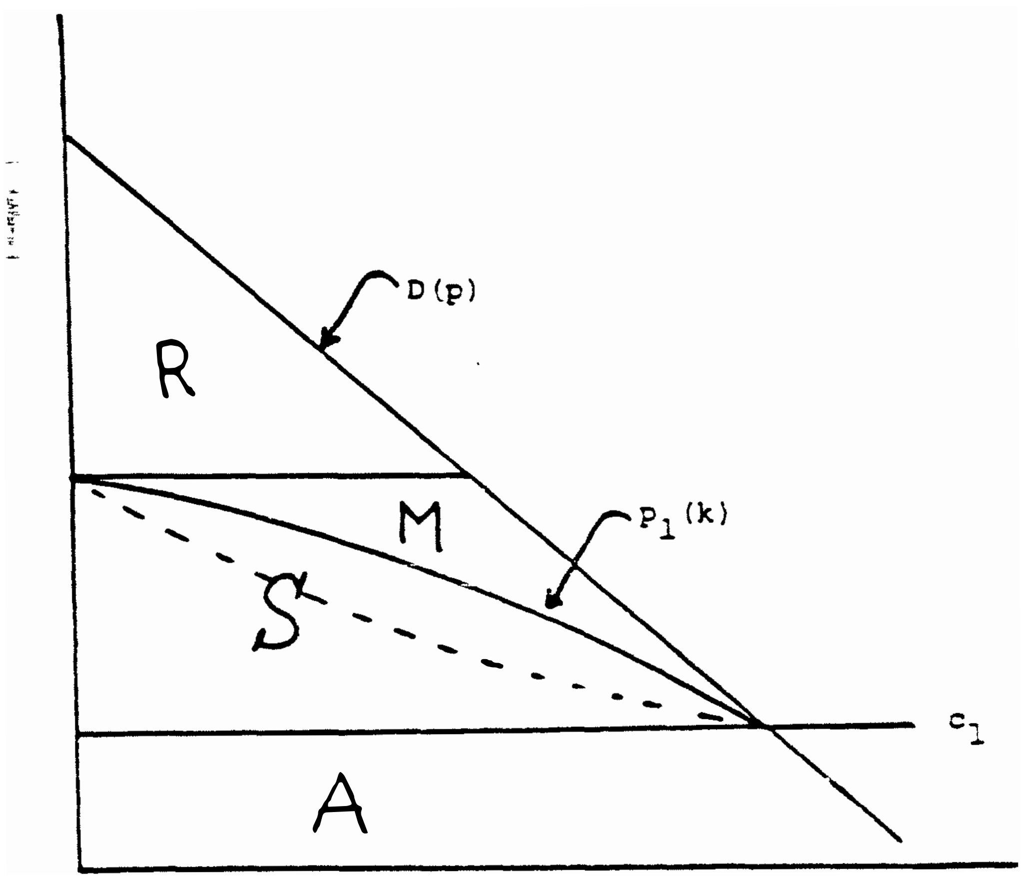


FIGURE 7: STRATEGY REGIONS

B. The Entrant's Problem

If the entrant issues coupons, it has two potential revenue sources: the sale of coupons and the sale of output. If the incumbent accomodates the entrant and does not honor the coupons, the entrant earns revenue from both sources. If the incumbent selectively matches by honoring the coupons, the entrant only earns revenue from coupon sales. Of course, if the incumbent matches or undercuts the entrant's price, the entrant earns no revenue.

The entrant chooses the (p_2, k) pair that maximizes its profits, taking into account the incumbent's reaction functions. If the entrant picks $p_2 < c_1$, the incumbent's best response is to accommodate its entry. Given this accommodation response, the entrant maximizes its profits as follows.[44]

(39) $$\Pi_{2A} = \max_{p_2, k} (p_2 - c_2)k + qk$$

$$\text{s.t. } q = \max [0, p_1 - p_2 - e]$$

$$p_1 = p_1(k)$$

$$p_2 < c_1$$

$$p_2 < p_1$$

$$e = 0$$

44 We set the infinitesimal $e = 0$ because it adds nothing to profits.

Substituting for q, p_1, and e, we have

(40) $$\Pi_{2A} = \max_{p_2, k} \; (p_1[k] - c_2)k$$

$$\text{s.t. } p_2 < c_1$$

Differentiating equation (40) and rearranging the first-order condition, we have

(41) $$k^a = -(p_1(k^a) - c_2) \,/\, p_1'(k^a)$$

where k^a denotes the entrant's optimal capacity choice, given that it issues coupons and induces an accommodation response. The choice of p_2 is obviously indeterminate as long as $p_2 < c_1$.

If the entrant picks $p_2 > c_1$, the incumbent selectively matches by honoring the coupons. Given that it induces the selective-matching response, the entrant sells no output. Hence, it maximizes its revenue from coupon sales as follows.

(42) $$\Pi_{2S} = \max_{p_2, k} \; qk$$

$$\text{s.t. } q = \max\,[0,\ p_1 - p_2 - e]$$

$$p_1 = p_1(k)$$

$$p_2 > c_1$$

$$p_2 < p_1$$

$$e = 0$$

Substituting for q, p_1, and e, we have

(43 $$\Pi_{2S} = \max_{p_2, k} \; (p_1(k) - p_2)k$$

$$\text{s.t. } p_2 > c_1$$

By inspection, it is clear that the entrant maximizes its profits by setting $p_2 = c_1$. Substituting into equation (43), we have

$$\Pi_{2S} = \max_k \; (p_1(k) - c_1) \, k \tag{44}$$

Differentiating equation (44) and rearranging the first-order condition, we have

$$k^s = -\,(p_1(k^s) - c_1) \,/\, p_1'(k^s) \tag{45}$$

where k^s denotes the entrant's optimal capacity choice, given that it issues coupons and induces selective matching.

Comparing equations (44) and (40), it is clear that the entrant prefers inducing the incumbent to honor its coupons if and only if the entrant is the higher cost producer. Stated formally,

$$\Pi_{2S} > \Pi_{2A} \quad \text{iff } c_2 > c_1 \tag{46}$$

For a given k, a less efficient entrant earns a larger margin $(p_1(k) - c_1)$ on each unit if it induces selective matching than if it induces accommodation. Comparing equations (41) and (45), it is easy to show that by inducing the incumbent to honor coupons, the less efficient entrant may select a larger k, or

$$k^s > k^a \tag{47}$$

This is illustrated in Figure 8. Figure 8 also illustrates the property that $p_1(k^s) < p_1(k^a)$. Thus consumers gain as well.

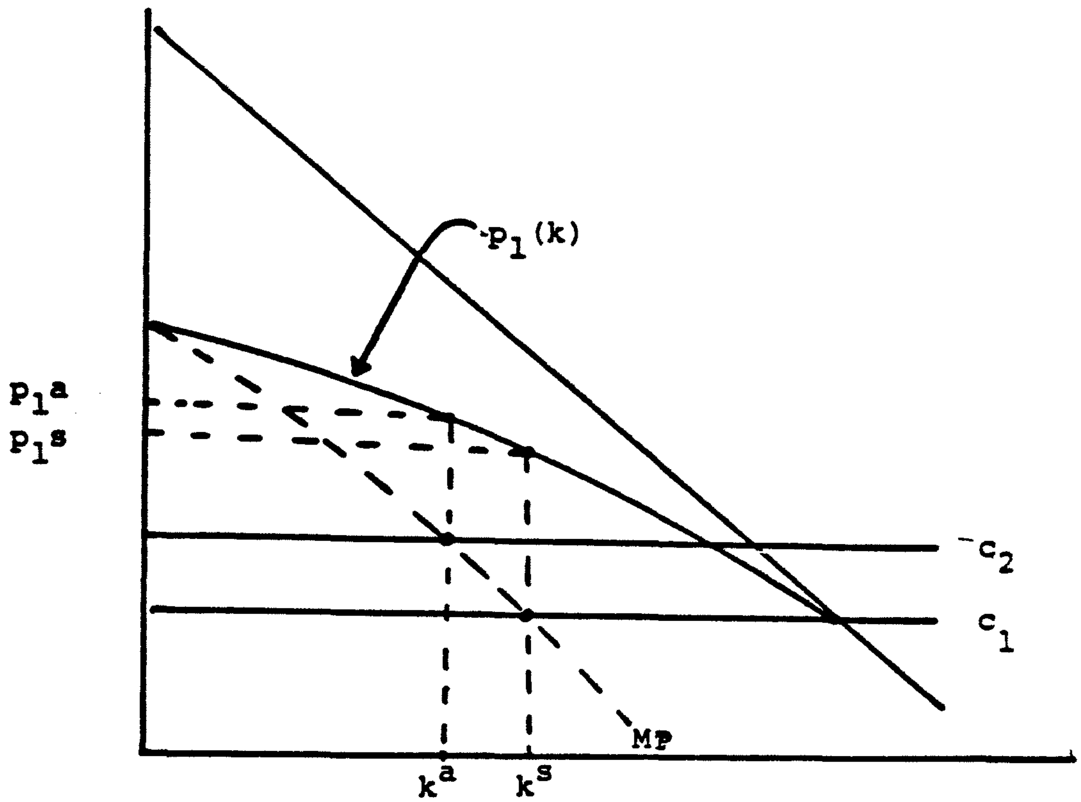


FIGURE 8: COUPONING STRATEGIES

If the entrant prevents the incumbent from honoring its coupons, selective matching is, of course, impossible, and equations (40) and (41) represent the entrant's maximized profits and optimal capacity respectively. Thus, it follows that the less efficient entrant is better off issuing coupons that can be honored by the incumbent.[45]

---

[45] This issue does not arise for a more efficient entrant. At $p_2 < c_1$, the incumbent does not wish to honor coupons.

We summarize the results of this section as follows. Given that it issues coupons, a less efficient entrant maximizes profits by selecting a high strike price ($p_2 > c_1$), which induces the incumbent to selectively match and honor the coupons. Conversely, a more efficient coupon-issuing entrant maximizes its profits by choosing a low strike price ($p_2 < c_1$) to induce accommodation by the incumbent.

These strategies also rationalize industry production. In each case, the k units are produced by the lower cost firm. In the case of a less efficient entrant, this rationalization of industry production cannot occur unless the entrant issues coupons.

C. Comparison of Coupon Competition to Pure Capacity Limitation

In this subsection, we compare the efficiency properties and entrant's profits under coupon competition and under capacity limitation with reservation price rationing.

In the case of a less efficient entrant, profits under coupons, as given by equation (43), exceed profits under capacity limitation, as given by equation (9), for any given level of capacity. Since a coupon-issuing entrant may set its price and capacity at (p_2^*, k^*)--the profit-maximizing choice under capacity limitation--its profits at its selective-matching optimum ($p_2(k^s)$, K^s) must be at least as great. Thus, a less efficient entrant is clearly better off when it sells coupons.

Whether the less efficient entrant's use of coupons also increases efficiency depends on the relationship between the marginal-revenue curves of the demand curves $\phi(k)$ and $p_1(k)$. Differentiating $\phi(k)k$ and $p_1(k)k$ with respect to k, these marginal curves can be written as

(48) $M\phi = \phi'(k)k + \phi(k)$

(49) $MP = p_1'(k)k + p_1(k).$

For the profit-maximizing (p_2, k) pair under coupon competition to result in unambiguously larger choice of $\bar{k}$ by the entrant and an unambiguously lower market price $\bar{p}_1$, it is sufficient that $M\phi$ lie everywhere below MP. This case is illustrated below in Figure 9.

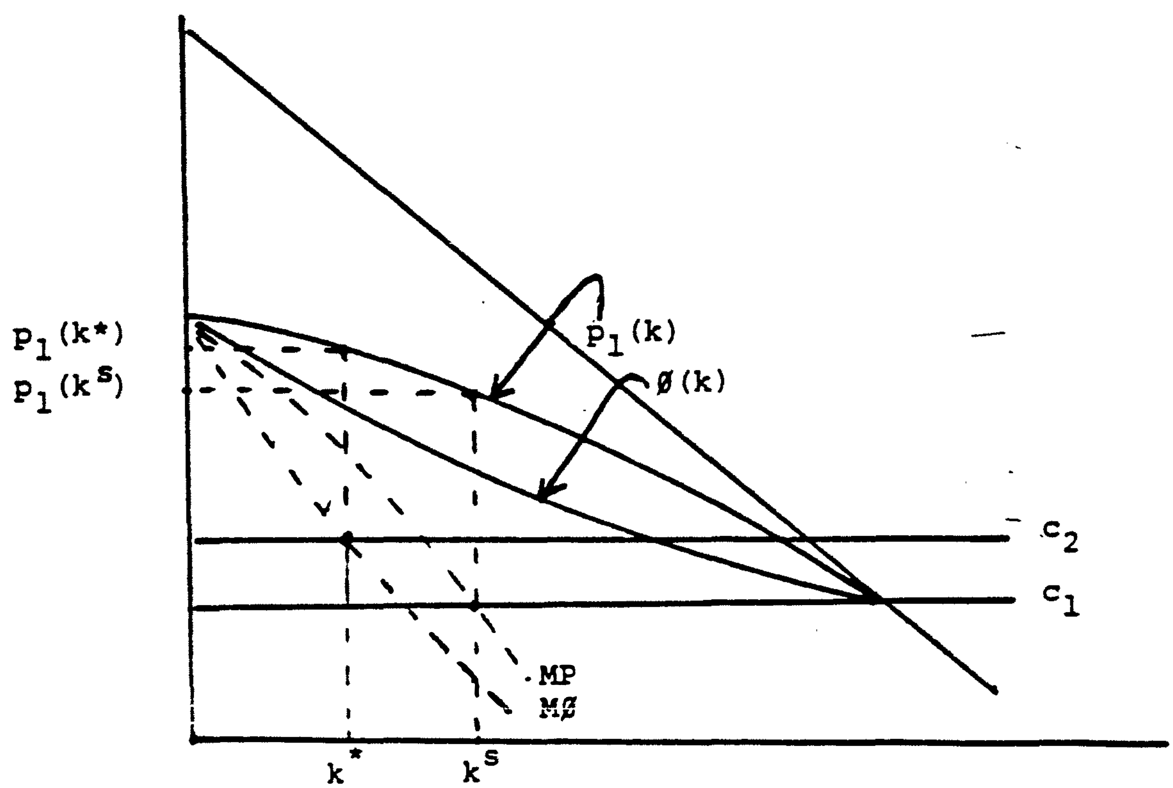


FIGURE 9: COUPONS VS. CAPACITY LIMITATION

We now discuss the case of a more efficient entrant. Comparing equations (40) and (9), it is easy to show that a more efficient entrant prefers selling coupons to limiting capacity and setting $p_2 > c_1$. A more efficient entrant has an alternative strategy as well: it can undercut the incumbent and supply the entire market. A more efficient entrant will therefore only choose to issue coupons if its profits from coupons exceed its profits from pricing below the incumbent's marginal cost. Comparing its maximized profits under couponing, given by equation (40), to the maximized profits from undercutting, the entrant prefers to sell coupons if and only if[46]

$$(50) \quad (p_1(k^a) - c_2)k^a > (c_1 - c_2)D(c_1).$$

Unlike the case of a less efficient entrant, the introduction of coupon strategies does not necessarily improve efficiency, even in the simple case where $M\phi$ lies everywhere below MP. There is typically some range of $c_2 < c_1$ for which the entrant prefers undercutting the incumbent to limiting capacity but prefers selling coupons to undercutting. For such an entrant, the ability to sell coupons results in lower output by the entrant, a higher market price p_1, and more production by the high-cost incumbent.

[46] Of course, in the case where the entrant's unconstrained monopoly price would under cut the incumbent, coupons have no value.

D. Summary

In summary, it is profitable for the leader-entrant to sell rights (coupons) for its limited capacity. Further, it is in a less efficient entrant's interest to set the "strike" price high enough that it is profitable for the incumbent to honor those coupons. This leads to an equilibrium where the entrant earns revenue only from the sale of coupons; it sells no output. Although the "strike price" for its output (when accompanied by a coupon) is p_2, consumers only realize the benefit of the reduction in the incumbent's price $p_1(k)$. The entrant obtains the windfall profit.

Similarly, coupons enable the more efficient entrant to enter the industry without competing away all the industry's pre-entry profits. By selling the rights to its discounted output, the entrant can collect a share of the profits it protects by limiting its capacity. Although consumers would prefer that the more efficient entrant undercut the incumbent rather than issue coupons, coupons may result in a lower market price and higher level of industry output than would occur under simple capacity limitation.

The sale of coupons also facilitates the rationalization of industry production. As stated in equation (46), independent profit maximization leads the entrant to set its output price so that the incumbent accepts coupons and produces the k units of output only if the incumbent is the more efficient producer. When the entrant is less efficient, this results in an industry cost savings of $(c_1 - c_2)k$. This savings accrues entirely to the entrant as profits.

Finally, coupons represent a cost-effective way for a less efficient entrant to (at least partially) overcome the incumbent's lexicographic first-entrant advantage. In effect, the entrant extorts some of the incumbent's profits by threatening to produce k units unless it is bought off. Faced with this credible threat, the incumbent's profit-maximizing response is to (implicitly) purchase the rights to this output. While the market mechanism by which these deals are carried out is fairly complex in its details, it quite simple in its essence: the entrant blackmails the incumbent into sharing its profits by threatening to spoil the market.

In the case of the less efficient entrant, the sale of high-priced ($p_2 > c_1$) coupons not only represents an "efficient" cartel management technique; it also has benefits for consumers. Compared to a market where the less efficient entrant cannot limit its capacity (and thus would not enter), coupon competition drives the price down from p_{1m} to the lower $p_1(k)$. As such, coupons allow the entrant to appropriate some of the surplus generated by its entry.

V. THE GREAT AIRLINE COUPON WARS

Although the capacity-limitation model has not been previously formalized, it is part of the oral tradition that entrants remain small in order to deter retaliation by the dominant firm.[47] There is, however, probably no better illustration of the analysis presented here than the recent experience in the airline industry. First, consumer demand across air carriers appears to approximate the lexicographic-preference assumption. Consumers seem reluctant to abandon the incumbent unless the entrant offers a lower price. (One explanation for this is that the incumbent has more flights and therefore consumers call the incumbent first.) However, even at a small price differential, the entrant makes large inroads. In addition, the entrant's capacity is easily observed by the incumbent. As our model predicts, there have been numerous cases of entrants strategically limiting capacity. There have also been several episodes of coupon competition. We take up the case of capacity limitations first.

A. Capacity Limitations

The notion that incumbents (who cannot price discriminate) only respond fully to low-priced entrants if they become large is a noncontroversial one in the airline industry. The International Air Transport Association (IATA) carriers only responded to international charters when they became "significant." For example,

---

47 For example, see Scherer (1980), pp. 248-49.

capacity limitations were placed on Laker Airlines and his low price was not matched.

TWA's 1978 "Super Coach" fare represents a particularly interesting episode of capacity limitation. During this early phase of air deregulation, carriers needed CAB approval for fare decreases. Because regulatory standards had previously favored proposals that did not injure rivals, TWA provided the CAB (and its rivals) with a detailed rationale for why the "Super Coach" proposal would not harm competitors. An unprofitable carrier on the Chicago-Los Angeles route, TWA wished to cut its coach fare in conjunction with a substantial reduction in its capacity. TWA argued that it would improve its capacity utilization (load factor) and because its capacity would shrink, the demand for its competitors' flights would rise. Of its rivals, Continental protested most strenuously. Due to its peculiar route structure, Continental felt that the "Super Coach" fare would, on balance, divert passengers from its flights while TWA's capacity reduction would increase the load factors for the other carriers. In its filing, Continental stated that it would have no choice but to match TWA's fare (and spread the discount to Milwaukee and San Diego too!).

Recently, there have been a number of episodes of price matching that violate the model presented in this paper. During the winter of 1981-82, Continental Airlines lowered the price of its "one-stop" transcontinental service. Although Continental had only a small market share, its transcontinental rivals matched the price even for their nonstop flights. Apparently a sophisticated marketer, Continental claimed to be puzzled at its competitors' overreaction. A Continental spokesman pointed to its limited capacity and deep discounts to show that retaliation was costly and not in its rivals' self-interest.[48]

Of course, air carriers can sometimes selectively lower prices to customers who might be offered a discount fare. When the preferred group is readily identified, the incumbent can match the entrant's price selectively and the entrant loses its leverage. For example, the multitude of "restricted fares" offered since the deregulation have generally been matched. Thus, the capacity-limitation model is most relevant in cases where the incumbent is unable to match selectively.

B. Coupon Competition

The airline industry also provides several examples of coupon competition. Indeed, explaining that competition was the original motivation for this paper.

Airline coupons were first introduced by United in May 1979, after a long strike. Rather than lowering its coach fares (which would be matched), it distributed transferable coupons on all of

---

48 Based on an article by Carole Shifrin, The Washington Post, 2 February 1982, p. C12.

its flights for a short period. Each transferable coupon entitled the bearer to a 50-percent discount on almost any United flight. Within days, American began to distribute its own coupons. Each subsequently chose to accept the other's coupons; Pan Am also accepted United and American coupons.[49]

An aftermarket for the coupons developed almost immediately and considerable coupon speculation ensued. This aftermarket was far more complicated than the simple one in our analysis. First, because the coupons had an expiration date, the market had dynamic elements. Second, carriers accepting coupons had the option of recycling them.[50] Third, coupon values depended on the price of the restrictive "Super Saver" discount fare as well as on the coach fare to which they were pegged.

Finally, the airlines did not sell the coupons directly. However, United gained in two ways. First, it obtained massive publicity. Second, demand by consumers (and travel agents) for United flights increased because the "free" coupons could be resold.

---

[49] Pan Am also distributed coupons but use was sufficiently restricted as to virtually eliminate their exchange value.

[50] In the model of Section IV, it is not in the dominant firm's interest to recycle the coupons. That would simply increase the number of low-priced units to 2k. However, with multiple "incumbents," all recycled coupons do not return to the recycler. Hence, the issue is more complex.

The second coupon episode involved an element of entry deterrence as well as entry accommodation. In the summer of 1980, Estern Airlines faced two competitive challenges. First, it was attempting to enter the transcontinental market. Second, it was combating the entry of New York Air on its profitable Air Shuttle routes (DC-NY; NY-Boston). Eastern began to distribute coupons on the Shuttle that were good for a 50-percent discount on its transcontinental flights. By introducing coupons, Eastern lowered its "effective" Shuttle fare because consumers could sell or use the coupons. Because Eastern had substantial excess capacity on its transcontinental flights, the discount may have been profitable even if it had been forced to honor all its coupons. However, United and American accepted these coupons and Eastern subsequently cut back its transcontinental flights.

One interesting element of this episode concerns the Eastern-New York Air interaction. Before introducing coupons, Eastern was playing the role of incumbent and New York Air the role of a small fringe entrant with limited capacity on the Shuttle routes. When United and American decided to accept the Eastern coupons, Eastern was able both to decrease its effective fare on the Shuttle and to have the discount subsidized by United and American. In effect, one could characterize the episode as Eastern attempting to predate against New York Air, using United and American's "deep pockets" to finance its adventure.

Airlines have also offered coupons with very low "strike" prices. Western Airline's recent "Mahalo" fare is one example. A passenger taking a medium-range (400 miles or more) round-trip flight on Western and paying full price received a coupon entitling the holder to a Hawaii flight for $100. This fare is sufficiently low that we suspect that it will not be matched. (However, we will not know for sure until the coupons expire on May 27, 1982.) We do know that the Western discount has induced both United and Northwest to lower their coach fares to Hawaii, but the reduction is not enough to match the Western price.

A final coupon episode concerns a $1 price-fixing conspiracy.[51] In 1977, six Maryland real-estate-brokerage firms were convicted of price fixing. A class-action-suit consent agreement required the six firms to give each injured buyer a transferable coupon entitling the bearer to a 1-percent commission-rate discount on a future house sale. The coupons expire on December 31, 1985. The defendants also agreed to operate a white market for the coupons. Subsequently, competing realty firms protested the settlement because they felt the defendants would "unfairly" attract extra sales. The court ruled that other brokers should be permitted to accept the coupons. Almost 100 brokers have agreed to do so.

---

[51] This section is based on an article by John Burgess in The Washington Post, 16 March 1981, p. B1.

VI. CONCLUSIONS

This paper has presented a new model of incumbent/fringe interaction where the entrant can make a binding commitment to limit its capacity. By setting a low price and limiting its capacity, the entrant makes accommodation more profitable than retaliation in two ways. The capacity limitation restricts the incumbent's losses in market share from accommodation. The low price of the entrant's output increases the incumbent's losses from matching. Thus, the entrant's ability to limit capacity can at least partially offset the incumbent's advantage.

The entrant can further increase its own profits by coupling the capacity limitation with sales of the rights (coupons) for its scarce output. If the incumbent has a cost advantage, this leads to an industry equilibrium in which the entrant sells no output, only coupons, and all output is produced and sold by the incumbent.

There are many questions left unanswered. The structure of the model is special and many properties of the equilibrium remain to be analyzed. Among the more important areas for further analysis are multiple entrants leading to a free-entry equilibrium. Even within the context of the present model, we have not explored the relative profits nor the shares gained by an equally efficient entrant. In addition, we have not analyzed in sufficient detail contractual clauses as meeting-competition, beating-competition, and most-favored-nation provisions.[52] The oligopoly model clearly needs additional work.

Finally, there remains the fundamental unanswered question. If coupon competition is so profitable, why does Chrysler sell K-Cars rather than coupons?

---

52 Many of these issues are explored in more detail in Salop (1982).

REFERENCES

D'Aspremont, C.; Gabszewicz, J. J.; and Thisse, J. F. "On Hotelling's 'Stability in Competition.'" Econometrica 47 (1979), pp. 1145-50.

Green, E. J., and Porter, R. H. "Noncooperative Collusion Under Imperfect Price Information." California Institute of Technology, 1981. (Manuscript.)

Guasch, J. L., and Weiss, A. "Adverse Selection by Markets and the Advantage of Being Late." Quarterly Journal of Economics 94 (1980), pp. 453-66.

Salop, S. C. "Practices That (Credibly) Facilitate Oligopoly Coordination." Paper presented at the IEA Symposium on New Developments in Market Structure, Ottawa, Ontario, 10-14 May 1982.

Salop, S. C. "Strategic Entry Deterrence." American Economic Review 69 (1979), pp. 335-38.

Salop, S. C. "Monopolistic Competition With Outside Goods." Bell Journal 10 (1979), pp. 141-46.

Schelling, T. C. The Strategy of Conflict. Cambridge: 1960.

Scherer, F. M. Industrial Market Structure and Economic Performance. 2d ed. Chicago: 1980.

Schmalensee, R. "Entry Deterrence in the Ready-to-Eat Breakfast Cereal Industry." Bell Journal 9 (1978), pp. 305-27.

Schmalensee, R. "A Model of Pioneer Brands." American Economic Review, forthcoming June 1972.

Spence, A. M. "Entry, Capacity, Investment, and Oligopolistic Pricing." Bell Journal 8 (1977), pp. 534-43.

Stigler, G. J. "A Theory of Oligopoly." Reprinted in The Organization of Industry, by G. J. Stigler. Homewood, Ill.: 1968, pp. 39-66.