

Product Differentiation Advantages
of Pioneering Brands

by
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ABSTRACT

A model is presented in which first entrants obtain demand advantages that can be used, if scale economies are present, to deter any later entry. Firms do not advertise, and buyers are rational but unable to judge the quality of new brands of experience goods prior to purchase. A buyer's favorable experience with a pioneering brand changes the standard used when deciding to try the offerings of later entrants. This effect is shown to be robust against a variety of changes in assumptions, and some of its implications for research and policy are discussed.

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Joe Bain's seminal empirical work on conditions of entry led him to conclude that product differentiation advantages of established sellers are the most important barrier to entry. As he put it, "the advantage to established sellers accruing from buyer preferences for their products as opposed to potential-entrant products is on the average larger and more frequent in occurrence at large values than any other barrier to entry " (p. 216). Treating advertising as a proxy for product differentiation, a sizeable literature has attempted to test this assertion by relating advertising to profitability in cross-section.¹ Bain's own discussion of product differentiation advantages does not point in this direction, however. He concludes that advertising does not seem to be the central force at work:

All of these things might seem to suggest the existence of fundamental technical considerations, institutional developments, and more or less fundamental consumer traits which make possible or even very probably the development of strong and stable product-preference patterns. They may also suggest that advertising per se is not necessarily the main or most important key to the product-differentiation problem as it affects intra-industry competition and the condition of entry. Although instances are found in which it is, we may need in general to look past advertising to other things to get to the heart of the problem. (p. 143)

Bain does not explicitly describe the mechanism by which product differentiation advantages of established sellers are created, but a number of his remarks point toward buyer uncertainty about product quality as centrally involved. Thus he states that within his sample of industries, "the allegiance of consumers to established products in areas in which they are ignorant or uncertain concerning the actual properties of products is quite important" (p. 130).² This suggests that in at least some cases, established firms' advantages might rest on such ignorance

or uncertainty, so that being first in a market and becoming known by consumers might be more important than merely spending a lot on advertising.

Conventional wisdom in marketing and scattered empirical research both support the notion that there are important advantages to being the first entrant in some markets. Marketers generally predict little success for "me-too" brands, those claiming to be identical to established brands but selling at a lower price.³ Ronald Bond and David Lean (1977, 1979) find that important and long-lived advantages are enjoyed by pioneering brands of prescription drugs, advantages that can be overcome by later entrants only if they offer distinct therapeutic benefits, not just lower prices. Ira Whittin's study of cigarette market segments points in this same direction, as do the cross-section analysis of marketing costs by Robert Buzzell and Paul Farris and the study of order-of-entry effects reported by Glen Urban and his associates. Finally, experiments described in the marketing literature by W.T. Tucker, J.C. McConnell, and others reveal that consumers are willing to pay a premium to continue purchasing brands with which they have acquired experience, even when all "brands" are identical in appearance and in fact.

This essay presents and explores a simple market model in which rational buyer behavior in the face of imperfect information about product quality gives long-lived advantages to pioneering brands. This model neglects advertising entirely and is thus consistent with Bain's apparent feeling that consumer uncertainty could be more important than advertising outlays in establishing production differentiation entry barriers.⁴ The next section describes the assumptions and notation employed and outlines the analysis of Sections II-V. Our findings and their implications for future research

and for public policy toward what Bain (p. 143) termed "the product-differentiation problem" are summarized in Section VI.

I. Assumptions and Notation

Consider a narrowly-defined product class, like freeze-dried instant coffee or stainless steel razor blades, such that individual consumers can be sensibly modeled as using at most one brand in the class at any instant. It is assumed for simplicity that brands in this class either "work" or "don't work"; they either perform as a brand in this class should, or they fail to perform acceptably. This makes it possible to describe uncertainty about the quality of a new brand by a single parameter, the subjective probability that it won't work. It is assumed that these products are what Phillip Nelson (1970) christened "experience goods", so that the only way a consumer can resolve uncertainty about quality is to purchase a brand and try it. One trial is both necessary and sufficient to determine whether or not any single brand works. After a consumer has tried a brand, its trademark provides complete information about its quality. (Word-of-mouth spread of quality information is thus assumed away; its impact is discussed briefly in Section V, below.)

Consumers differ in their valuation of brands in this class. Let the function $Q(v)$, $0 \leq v \leq V$, give the number of consumers willing to pay at least v for a brand in this class that is certain to work. Suppose that prior to the introduction of the first brand, all consumers have subjective probability π that it will not work. Each values a unit that doesn't work at $(-\phi v)$, with ϕ a non-negative constant that is the same for all consumers. (One might have $\phi > 0$ for a bleach that could ruin clothes, for instance.)

The time between purchases is assumed constant and equal to one period.

Trial of a new brand thus consumes the entire normal inter-purchase time. (It is shown in Section V that this assumption is inessential.) Let the corresponding one-period discount rate, assumed common to all consumers, be r . All else equal, more frequent purchase implies a smaller value of r . The assumption that all consumers have the same values of π , ϕ , and r is not as restrictive as it might appear. Much of what follows can be interpreted as applying to a subset of consumers with common values of these parameters, with more general results obtainable by aggregation over all such subsets. Consumers are assumed to be risk-neutral, to have infinite horizons, and to behave rationally.⁵

Consumers are perfectly informed except about product quality, and their tastes are fixed, so that neither informative nor persuasive advertising occurs. For simplicity, it is assumed that all brands actually marketed work, even though consumers initially attach a positive probability to their not working. Thus the value of any brand's trademark rises every time a consumer tries that brand for the first time. There is no contradiction here. As Nelson (1974) and others have pointed out, it is difficult for sellers to transmit quality information for experience goods to rationally skeptical buyers. All brands are assumed to have identical production costs; they differ only in the order in which they appear on the market.

The analysis below considers a two-stage scenario. In the first stage, a pioneering brand enters the market and attains steady-state equilibrium. Since consumers are initially skeptical about its quality, the first brand might be expected to find it optimal to charge a low introductory price to induce trial and then raise the price once consumers have verified that the brand does work. The effectiveness of such a strategy must depend in part on the extent to which consumers initially foresee subsequent price changes.

Section II analyzes the first brand's pricing problem under the extreme assumption of static expectations. Section IV examines the implications of the opposite extreme assumption of perfect foresight.

In the second stage of the scenario, a second, objectively identical brand appears on the market. In order to focus on the effects of order of entry, it is assumed that the first brand does not change price in response to entry. This is a much more passive response to new competition than is usually considered plausible.⁶ In an undifferentiated world, this response would permit the second brand to undercut the first by an arbitrarily small amount, steal all the first brand's customers, and duplicate its profit performance. Similarly, it is initially assumed that the second brand is also subjectively identical to the first brand at the time of introduction, so that the same values of π , ϕ , and r and the same $Q(v)$ function apply to both. Section III analyzes the second brand's problem under these assumptions for the case of static expectations. It is shown that the difficulty of persuading rational consumers to make a second investment in quality verification in the same product class produces a permanent disadvantage. If the second brand undercuts the first only slightly (in a present value sense), it will make only negligible sales. This asymmetry can be used to deter entry if economies of scale are present. Section IV demonstrates that these conclusions are equally valid in the polar opposite extreme case of perfect buyer foresight.

The consequences of relaxing the assumptions that buyers assign the same initial probability of inadequacy to both first and second brands and that they know for certain the value to them of an adequate brand are explored in Section V, along with other extensions of the basic analysis.

In Schmalensee (1980), this basic setup is analyzed under the assumption

that buyers correctly expect sellers never to change price. This assumption is very ad hoc, but it drastically simplifies the analysis without altering the basic nature of the conclusions. Since both brands actually work, each sells forever to those consumers who try it when it is introduced and to no others. Both brands then have well-defined demand curves, with the second brand's curve depending on the first brand's price. It is shown that the second brand's demand curve has the first brand's price as its intercept. It coincides with the first brand's demand curve only for prices distinctly below the first brand's price. This means that with economies of scale, the (common) long-run average cost schedule can lie everywhere above the second brand's demand schedule even though the first brand is earning positive profits. The analysis below obtains essentially the same results without restricting price changes. Since the second brand's demand curve turns out not to be easily defined in general, however, there does not seem to be a simple graphical description of the second brand's disadvantage.

II. Pricing the Pioneering Brand

In this Section and the next, buyers have static expectations; they expect the most recently observed price to hold forever, even if price has changed in the past. Suppose that in order to try a new brand, a consumer ceases for the trial period to use a substitute that yields a non-negative surplus, s . Assuming away income effects and indivisibilities, one can take $s = 0$ for the first brand.

If a consumer would be willing to pay v for a working brand in this class, trial of a new brand selling at price p is rational if and only if

the following inequality is satisfied:

$$(1) \quad \pi [(-\phi v - p) + (s/r)] + (1 - \pi) [(v - p)(1 + r)/r] \geq s(1 + r)/r.$$

The first bracketed term on the left gives discounted surplus if the new brand is tried, doesn't work, and the consumer switches back to the substitute. The second term on the left capitalizes the stream of surplus associated with buying a brand that works at price p forever, and the term on the right gives the capitalized benefit of continuing to purchase the substitute. The left-hand side of (1) exceeds the expected surplus associated with switching to the new brand forever by $[(\pi/r)(s + \phi v + p)]$, the value of the option to switch back if the new brand is found not to work.

Inequality (1) can be re-written simply as

$$(2) \quad p \leq v(1 - r) - s,$$

where the important quantity τ is defined by

$$(3) \quad \tau = \frac{\pi r(1 + \phi)}{1 + r - \pi}$$

If $\tau = 0$, condition (2) indicates that the new brand will be purchased if and only if its net surplus, $v - p$, exceeds s . Larger values of τ always discourage trial of a new brand. As one would expect, τ is increasing in both π and ϕ , as these contribute to the expected cost of trial. Larger values of r , which correspond to lower purchase frequency, also increase τ . The lower is purchase frequency, the more important is any single purchase relative to the entire future stream of purchases. This makes the risk associated with

trying a new brand loom larger relative to the alternative of sticking forever with the substitute. If $\tau \geq 1$, condition (2) shows that trial is so subjectively risky that it will never occur at positive p . To rule this out, let us assume $0 < \tau < 1$ in all that follows.

If the first brand on the market charges price p , and all buyers with $v > p$ are sure that it works, its sales equal $Q(p)$. Let $\Pi(p)$ be the per-period profit function corresponding to this demand curve, and let P^* be the unique maximizer of $\Pi(p)$. When the first brand initially appears on the market, nobody is sure that it works, and condition (2), with $s = 0$, implies that a price p will produce sales of $Q[p/(1-\tau)]$. Let the profit function corresponding to this less attractive demand curve be $\Pi^0(p)$, and let this function have a single maximum where $p = P^{0*}$. It is easy to show that $\Pi[p/(1-\tau)] > \Pi^0(p)$ for all positive p such that $q(p) > 0$, and that $P^{0*} \geq P^*(1-\tau)$, with equality if and only if marginal cost is zero.⁸

In period 1, let $\underline{p} = V(1-\tau)$, and in later periods let \underline{p} equal the lowest price previously charged. The demand curve for the pioneering brand then has the general shape of the solid kinked curve in Figure 1. If $p < \underline{p}$, some new buyers are reached, and profits equal $\Pi^0(p)$. If $p \geq \underline{p}/(1-\tau)$, the only buyers are those who have purchased the brand at least once before, and profits are given by $\Pi(p)$. If $\underline{p} \leq p < \underline{p}/(1-\tau)$, current profits could obviously be increased, and no new customers are being informed, so that prices in this range can never be optimal.

If the first brand adopts what I will call a monopoly Q-constant strategy, it selects prices p and p^0 to solve

$$\max \Pi^0(p^0) + (1/r)\Pi(p), \quad \text{s.t.} \quad p(1-\tau) \geq p^0.$$

Since $P^*(1-\tau) < P^{0*}$, the constraint is binding. This means that the optimal

policy involves a price of $P_1(1-\tau) < P^{0*}$ in the first period and a price of $P_1 > P^*$ thereafter. Output is constant over time, at a level below that of a monopoly with profit function $\Pi(p)$ because of the extra marginal cost required to persuade buyers to try an ex ante risky product. This sort of low/high sequence corresponds roughly to what is called "penetration pricing" in the marketing and managerial economics literatures.⁹

I now want to show that the monopoly Q-constant strategy just described is a globally optimal policy for the first brand, at least as long as no thought is given to possible subsequent entry. The problem here is stationary, with the state of the system in any period completely described by the value of \underline{P} , the lowest price previously charged. By stationarity, if it is ever optimal to price above \underline{P} and thus to leave the state of the system unchanged, it must be optimal to charge the same price forever afterward. It is similarly clear that any optimal sequence of price changes must be finite and must end with a change to a price at least equal to $\underline{P}/(1-\tau)$, with that price maintained thereafter.¹⁰ Thus if a Q-constant strategy is not optimal, any optimal sequence must have prices P_a , P_b , and P_c charged in successive periods, with $P_c \geq P_b/(1-\tau)$ charged thereafter, $P_b < P_a$, and P_a less than \underline{P} at the start of the relevant period. If a sequence of this sort is optimal, it must be that

$$\Pi^0(P_a) + \frac{1}{1+r} [\Pi^0(P_b) + \frac{1}{r} \Pi(P_c)] \leq \Pi^0(P_b) + \frac{1}{r} \Pi(P_c).$$

But re-arrangement and use of results above yield directly

$$\Pi^0(P_b) + \frac{1}{r} \Pi(P_c) \leq \frac{1+r}{r} \Pi^0(P_a) < \Pi^0(P_a) + \frac{1}{r} \Pi[P_a/(1-\tau)].$$

This last inequality implies that discounted profits could be increased by moving to $P_a/(1-\tau)$ from P_a rather than going to P_b and P_c , thus contradicting the assumption that the second sequence is optimal and establishing that the first brand's optimal policy must be a monopoly Q-constant strategy involving a single price change.

If it is concerned about subsequent entry, the first brand might adopt some other type of strategy. By analogy with the work of Dixit and others, it might rationally charge a very low introductory price in order to induce many customers to try the product, then raise the price so that some who know it works find it too expensive. This initial investment would give the firm a lower effective marginal cost of reaching additional customers in response to entry. In order to highlight those aspects of later entrants' problems that arise naturally, I want to assume away this sort of strategic behavior on the part of the first brand. Allowing it could only strengthen the results obtained below at a high cost in added complexity.

On the other hand, little is gained by confining the first brand to the optimal Q-constant strategy defined above. It is thus assumed below only that the first brand follows some Q-constant policy, charging price $P_1(1-\tau)$ in the first period and P_1 in all periods thereafter and selling $Q(P_1)$ in all periods. Under any such policy, the levelized per-period equivalent to the monopoly's average revenue stream is simply

$$(4) \quad \bar{P} = \frac{r}{1+r} [P_1(1-\tau) + P_1/r] = P_1 \left[1 - \frac{r\tau}{1+r} \right] = P_1(1-t),$$

where the last equality serves to define t . Under any Q-constant policy, then, the first brand faces a demand curve relating levelized average revenue to quantity given by

$$(5) \quad Q = Q[\bar{P}/(1-t)].$$

Note that t is always between zero and τ . If the first brand were forbidden from changing price, as in Schmalensee (1980), its demand would be $Q[\bar{P}/(1-\tau)]$ in all periods. The difference between this function and (5) measures the value to the first brand of being able to raise price after the first period. It is immediate that t , like τ , is increasing in π , ϕ , and r .

III. Demand Conditions Facing a Later Entrant

Buyers are assumed here to have exactly the same expectations and beliefs about the second brand when it appears as they had about the first when it was introduced. It is shown in Section V that relaxing this slightly, for instance by letting a smaller π apply to the second brand, improves the second brand's position only slightly; the relation is continuous.

The second brand, unlike the first, faces two distinct types of consumer. If the first brand's price is P_1 , those consumers with $v \leq P_1$ have not bought the first brand. If the second brand then charges price p , the condition for trial is simply (2) with $s = 0$, as for the first brand:

$$(6a) \quad v \leq P_1 \quad \text{and} \quad p \leq v(1-\tau).$$

Consumers with high v 's are a second type of buyer, as they have already tried brand one and found it to work. Because purchase of brand one yields a surplus of $(v - P_1)$, the condition for trial is given by (2) with $s = v - P_1$:

$$(6b) \quad v \geq P_1 \quad \text{and} \quad p \leq P_1 - \tau v.$$

Condition (6b) shows that consumers with large values of v are least likely to try brand two, even though they were most likely to try brand one. Their high valuation of brand one, after they have made the investment of trying it, gives them a high opportunity cost of trying brand two.

The demand conditions facing brand two in its first period are depicted in Figure 2. Prior to the second brand's appearance, the first brand (assumed to have completed the introductory phase of a Q -constant policy) charges P_1 and sells $Q(P_1)$. If the second brand charges p_2 , its first-period customers are those with v 's between the two intersection points of the $p = p_2$ line with the heavy kinked curve. As Figure 2 is drawn, the second brand sells

$$Q[p_2/(1-\tau)] - Q[(P_1-p_2)/\tau]$$

in its first period. This is less than the first brand would have sold had it charged p_2 during its introductory period. Only if p_2 is less than $(P_1 - \tau V)$ are the second brand's introductory sales equal to those the first brand would have achieved at the same price.

Figure 2 should make it clear that the consumers most easily captured by the second brand are those with $v = P_1$. If the second brand undercuts the first brand's price sequence, $P_1(1-\tau)$ for one period and P_1 thereafter, by an arbitrarily small amount, it will sell only to those buyers with v 's arbitrarily close to P_1 . Such a policy would give the second brand a levelized average revenue equal to that of the first brand, $P_1(1-t)$, but essentially zero sales. Under constant returns, entry will occur in spite of this disadvantage (though at arbitrarily small sale) if $P_1(1-t)$ exceeds unit cost. With fixed costs or other economies of scale, however, it should be clear

that $P_1(1-\tau)$ can be above the first firm's average cost [at output $Q(P_1)$] without provoking entry.

If the second brand charges any first-period price between $P_1(1-\tau)$ and $P_1 - \tau V$, it makes fewer sales than the first brand would have made at the same introductory price. Since first-period sales translate into informed buyers willing to pay more because they know the brand works, this difference is the heart of the second brand's disadvantage. If the first seller of fluoride toothpaste can persuade those who care a lot about cavities to try one tube, and if the taste is acceptable to most consumers, the second brand of fluoride toothpaste will find it much harder to get trial. It will be compared to a known, acceptable fluoride toothpaste, while the first brand was compared only to "ordinary" toothpaste.

If the second brand charges an introductory price less than $P_1 - \tau V$, which is distinctly less than the first brand's introductory price, it thereby persuades all those who would have tried the first brand at that same price to try it. (That is, as Figure 2 should make clear, its first-period demand is then given by $Q[p_2/(1-\tau)]$, the same function that held for the first brand at all prices.) It then has essentially the same second-period options the first brand would have had. (The second brand cannot sell anything if it charges a price above P_1 , but this is not likely to be a relevant alternative.) If the first brand could have earned positive profit with a Q-constant strategy beginning with a very low first-period price, the second brand will find entry of the same sort attractive. Even with constant costs, however, is it obviously possible for the first brand to be highly profitable but entry at drastically lower prices to be unprofitable.

The preceding discussion establishes the existence of a barrier to entry. Profitable entry deterrence can occur in this model even though

potential entrants have the exceptionally optimistic expectation that the first brand's price will never change, even if they steal all its customers. In order to investigate the importance of this barrier in general, it would be necessary to calculate the second brand's optimal price policy and the consequences of following it. This turns out to be very difficult. The argument in Section II establishing that the first brand's optimal policy involves only one price change can be applied to the second brand also. The problem is that it is not always optimal for the second brand to follow a Q-constant policy.

The nature of the difficulty here can be understood by examining the second brand's demand curve for periods after the first, as shown by the heavy kinked curve in Figure 3. As above, \underline{P} is the lowest price this brand has ever previously charged, and P_1 is the first brand's price. Figure 3 is drawn assuming $\underline{P} > P_1 - \tau V$. The flat portion of the demand curve at price P_1 corresponds to those consumers who have tried both brands and know that both work. The segment AB reflects those who have tried only the second brand because they found the first too expensive. A reduction in \underline{P} increases the length of the flat segment (moves point A to the right) as well as that of the declining segment. If the optimal introductory price is above $P_1 - \tau V$, it may be optimal to follow a Q-constant policy and go to a point like B thereafter. On the other hand, since a low introductory price increases the number of brand one's customers who engage in trial, it may be optimal to set a low introductory price for this purpose and then move to a point like A in Figure 3.¹¹ Finally, since a reduction in the introductory price moves the whole segment AB to the right, it may be optimal to move to a point in the interior of

that segment for periods after the first. If the optimal introductory price is below $P_1 - V$, on the other hand, point A is unchanged by marginal variations in that price, and a Q-constant policy must be optimal. There are thus four distinct strategy types that may be optimal for the second brand in any particular situation, and it is apparently necessary in general to compare the profits streams they yield for given cost and demand functions and fixed P_1 to choose among them.

In lieu of any further general analysis, the remainder of this Section is devoted to an outline of an examination of the second brand's problem in a fairly tractable special case. Suppose that both brands have fixed, one-time setup costs of F and zero variable costs. Let consumers' valuations be uniformly distributed over the unit interval, and let the scale of the entire market be normalized to unity, so that $Q(v) = 1 - v$. If the first brand follows a Q-constant strategy, the present value of its profit stream follows from (4) and (5) above:

$$(7) \quad W_1 = \left[\frac{1+r}{r} \right] \bar{P}Q[\bar{P}/(1-t)] - F = P_1(1-P_1) \left[\frac{1+r-r\tau}{r} \right] - F.$$

Under a monopoly Q-constant strategy, this quantity is maximized by setting $P_1 = 1/2$.

Suppose that the second brand charges p^0 in its introductory period, with $P_1 - \tau \leq p^0 \leq P_1(1-\tau)$. Then its first period profit (and revenue) function is

$$\Pi_1^0(p^0; P_1) = \frac{p^0}{\tau} \left[P_1 - \frac{p^0}{1-\tau} \right].$$

In the second and later periods, if the second brand charges p its profits are given by

$$\Pi(p; p^0, P_1) = \frac{p}{\tau}[P_1 - p^0 - \tau p],$$

for $p^0/(1-\tau) \leq p \leq P_1$. The second brand's objective function is

$$(8) \quad W_2(p^0, p; P_1) = \Pi^0(p^0; P_1) + (1/r)\Pi(p; p^0, P_1) - F.$$

If $p^0 < P_1 - \tau$, the relevant objective function is identical to that of the first brand, and a Q-constant strategy must be optimal by the arguments in Section II.

Let us evaluate optimal strategies of the four types mentioned above. Considering point A in Figure 3, one can set $p = P_1$ in (8) and maximize W_2 with respect to p^0 . Under the assumption $r < 1$, the maximum occurs at the lower corner where $p^0 = (P_1 - \tau)$ and all brand one's customers have been persuaded to try brand two. Let W_2^A be the value of W_2 corresponding to this strategy. Considering point B in Figure 3, one can set $p = p^0(1-\tau)$ in (8) and again maximize with respect to p^0 . If $P_1 \geq 2\tau/(1+\tau)$, W_2 is again maximized at the point $p^0 = P_1 - \tau$. To simplify things here and below, let us assume that P_1 takes on its monopoly value, $1/2$, and that $\tau \leq 1/3$, so that this corner solution is the relevant one. Direct comparison then establishes that the corresponding value of W_2 , call it W_2^B , strictly exceeds W_2^A .

The third strategy type involves $p^0/(1-\tau) < p < P_1$, corresponding to points strictly between A and B in Figure 3. If such a strategy is optimal, the value of p that yields an unconstrained maximum of $\Pi(p; p^0, P_1)$, call it $p^*(p^0; P_1)$ must lie in this interval. (If not, the optimal price in periods after the first must be a corner solution at one of the endpoints.) Substituting $p^*(p^0; P_1)$ into (8) and differentiating, one finds that

$W_2[p^0, p^*(p^0, P_1); P_1]$ is decreasing in p^0 over the entire relevant range as long as $\tau(1+4r) \leq 1$. Assuming this last condition satisfied, as it is when $r \leq 1/2$ under our assumption that $\tau \leq 1/3$, and using $P_1 = 1/2$, the relevant lower bound on p^0 turns out to be $P_1 - \tau = P_1(1-\tau)/(1+\tau)$. At this point, however, $p^*(p^0; P_1) = p^0/(1-\tau)$, and we are at a point like B once again. Under these assumptions, in short, there exists no optimal strategy of the third (interior) type. Finally, the optimal Q-constant strategy for $p^0 \leq P_1 - \tau$ must have this constraint holding with equality, since the objective function is the same strictly concave one that held for the first brand and that is maximized at $p^0 = (1-\tau)/2 > (1/2) - \tau$. We are again at a point like B in Figure 3; this fourth strategy type also yields a present value of profits equal to

$$(9) \quad W_2^B = (1/4)[(1-2\tau)(1+r-r\tau)]/[r(1-\tau)^2] - F.$$

Setting $P_1 = 1/2$ in (7) and substituting into (9), we can relate the first brand's present value to that of an optimally-managed second brand:

$$(10) \quad W_2^B = [W_1 + F][1 - (\frac{\tau}{1-\tau})^2] - F.$$

If $\tau = 0$, $W_2^B = W_1$, and there is obviously no barrier. If $F = 0$, so that there are no scale economies, W_2^B is positive if and only if W_1 is positive. The second brand may be less profitable than the first, but its entry is not thereby deterred under our assumptions. In general, it is clearly possible for W_1 and F to be positive and yet for W_2^B to be negative. The parameter τ completely describes the magnitude of the second brand's demand disadvantage.

The larger is τ , the harder it is in general for both first and second brands to induce trial, and the worse is the relative position of the second brand in this example.

IV. Implications of Perfect Foresight

The assumption of static expectations used above no doubt understates buyer sophistication in many situations. Experienced consumers have certainly observed low/high "penetration pricing" more than once. Moreover, new products are sometimes introduced at prices that are labeled "Introductory" and that sometimes are even described as being some definite amount below "Regular List Price". If "Regular List Price" serves as an indicator of quality, sellers may find it in their interest to reveal planned post-introduction price increases to buyers.¹² Though it undoubtedly overstates both buyer sophistication and seller predictability in many situations, the assumption of perfect foresight regarding price changes does illuminate the general implications of forward-looking behavior. It is an extreme assumption that is fairly tractable and should serve, along with the opposite extreme assumption of static expectations, to bound actual consumer behavior in this context.

Under perfect foresight, any consumer's purchasing behavior depends on the entire future time-path of prices. But this picture becomes descriptively less plausible the more complex the time-path considered. Moreover, one rarely observes "penetration pricing" strategies for new brands involving complex sequences of price changes. Thus nothing of empirical relevance is likely to be lost if we allow sellers only one price change, from an introductory price of p^0 to a "regular" price of p .

Similarly, to facilitate comparison with the analysis above, all brands are restricted to strategies in which $p^0 \leq p$.¹³

If for some buyer $s \leq (v-p)$, a new brand will be tried in its introductory period, if at all, with the intention of buying it thereafter if it works. The condition for this sort of trial, following the development of (1), is

$$(6) \quad p \leq v - s \text{ and } \pi[(-\phi v - p^0) + (s/r)] + (1-\pi)[(v-p^0) + (v-p)/r] \geq s(1+r)/r.$$

Condition (6) can be usefully re-written as

$$(7) \quad p \leq v - s \text{ and } \hat{p} = \frac{p^0 r + p(1-\pi)}{r + (1-\pi)} \leq v(1 - \tau) - s.$$

It is possible for consumers with $s \geq (v-p)$ nonetheless to try a new brand in the first period, with no intention of repurchasing it, if p^0 is low enough. The condition for first-period-only purchase of this sort is simply that first-period expected net benefits be positive:

$$(8) \quad p \geq v - s \text{ and } p^0 \leq v[1-\pi(1+\phi)] - s = v(1 - \tau') - s,$$

where the last equality serves to define τ' . Referring to (3), it is clear that $\tau' > \tau$. Let us assume that risk is sufficiently moderate that $\tau' < 1$, so that first-period-only purchase is at least possible in principle.

To consider the first brand's pricing problem, set $s = 0$ in conditions (6) - (8), as above. It is easy to show that if it is optimal for the first brand to make any sales at all, it is optimal to make sales in all periods after the first. If this were not true, then (8) would imply the

optimality of selling $Q(v^0)$, for some v^0 , in the first period at v^0 per unit, then choking off demand with $p = v^0$ thereafter. Using (7), the pioneering brand can sell $Q(v^0)$ in all periods after the first (since the brand always works) by setting $p = v^0$ and $p^0 = v^0 [1 - \tau - \tau(1-\pi)/r] = (1-\tau')v^0$. It follows directly from condition (8) that this p^0 induces no first-period-only trial for $v < v^0$, so that $Q = Q(v^0)$ in all periods. But this pricing pattern yields equivalent levelized average revenue of

$$(9) \quad \bar{p} = \frac{r}{1+r} [p^0 + \frac{1}{r} p] = (1 - \frac{r\tau'}{1+r})v^0 = (1-t')v^0,$$

where the last equality defines t' . Since \bar{p} exceeds $(1-\tau')v^0$ for all finite r , the optimality of sales after the first period is established.

It is straightforward to show that the pricing pattern just described maximizes the present value of revenues from any fixed set of customers to be served in all periods. That is, assuming $Q(v^0)$ sold in all periods after the first and neglecting the profit implications of any first-period-only trials, the pricing pattern just described is profit-maximizing. A comparison of (7) and (9) shows that p has a larger impact relative to p^0 on the seller's present value, a multiple of \bar{p} , than on the buyers' cutoff criterion, \hat{p} . Buyers treat the probability that they will ever pay p after trial as $(1-\pi)$; the seller knows that the product works and thus treats this probability as one. Accordingly, the seller can increase the present value of revenues without excluding customers by raising p as high as possible and lowering p^0 so as to keep \hat{p} constant. Clearly p can be raised no higher than v^0 if all buyers with $v \geq v^0$ are to be induced to try the brand, and this yields exactly the pricing policy described in the preceding paragraph.

Let $Q(v^0) > 0$ be the first brand's optimal sales in all periods after the first. The preceding paragraph has established that $p^0 = (1-\tau')v^0$ and $p = v^0$ maximize the revenue derived from those sales. The second-period price, p , cannot be increased without reducing second-period sales. If p is decreased and p^0 increased so as to hold second-period sales constant, first-period sales are unaffected and discounted revenues fall. If the pricing pattern just described is not optimal, it therefore can only be the case that it is better to charge a lower value of p^0 , say $(1-\tau')(v^0-X)$, leave p fixed, and increase first-period sales by $[Q(v^0-X)-Q(v^0)]$. If such a change increases discounted profit, however, it can be further increased by lowering p by the same percentage amount to $(v^0 - X)$ and enjoying exactly the same sales increase in all later periods. But this contradicts the initial assumption that $Q(v^0)$ was the optimal sales level in periods after the first.

We have thus established that the first brand's optimal policy under our assumptions when buyers have perfect foresight is to charge $P_1(1-\tau')$ in the first period and P_1 thereafter, selling $Q(P_1)$ in all periods and receiving levelized average revenue given by (9) with P_1 substituted for v^0 . This is a Q-constant policy, though it differs quantitatively from those analyzed in Section II. A comparison of (4) and (9) reveals that the present value of the first brand's revenue per unit is always lower under perfect foresight, since t' exceeds t . It is harder to persuade rational consumers to try a risky new product if they know that today's low introductory price is temporary than if they expect it to hold forever, all else equal.

Suppose the first brand has followed such a Q-constant strategy and become established, and consider the demand conditions facing a later entrant. Buyers with v 's less than the first brand's price, P_1 , have not tried that

brand, so that conditions (7) and (8) still apply to them with $s = 0$. Their behavior with respect to any second brand would thus be given by exactly the same conditions that governed their response to the first brand. Buyers with valuations above P_1 are buying the first brand and enjoying a surplus of $(v - P_1)$ per period. Substituting this surplus for s in conditions (7) and (8) yields $(P_1 - v)$ in place of $v(1 - \tau)$ and $(P_1 - \tau'v)$ in place of $v(1 - \tau')$, respectively. The difference here is exactly like the difference between (6a) and (6b) under static expectations. Experience with brand one has altered the perceived opportunities facing some consumers in a way that makes trial of brand two less attractive.

As in the case of static expectations, the easiest buyers for brand two to steal from brand one are those with v 's arbitrarily close to P_1 . If the second brand just slightly undercuts the first brand's prices, it will get just those buyers. Exactly as before, the second brand cannot exceed the levelized average revenue earned by the first brand, and it can come close only by driving its own sales correspondingly close to zero. This means that if scale economies are present, entry deterrence is again possible even under our assumption of extreme entrant optimism that rules out price cuts by the first brand.

If the second brand elects to enter at a very low price, it can experience the demand conditions the first brand would have faced, just as under static expectations. If the second brand sets p^0 and p so that $\hat{p} \leq P_1 - \tau v$, it will induce all of brand one's customers to try its product. It will then have essentially the same options that the first brand would have had, had it elected to charge such low prices. If the second brand sets \hat{p} between $P_1(1 - \tau)$ and $P_1 - \tau v$, some buyers regularly consuming the first brand will rationally elect not to try the second, so that the second brand

will wind up with lower sales than the first would have had. As in the case of static expectations, it may not be optimal for the second brand to follow a Q-constant strategy in all cases, so that evaluation of the importance of its order-of-entry handicap generally requires comparison of the profit implications of several different strategy types.

Such a comparison is not undertaken here. The objective of this section was to establish that in the basic model of Section I, late entrants have a demand disadvantage, which can be used to deter entry if economies of scale are also present, even if consumers do not have static expectations. By showing that a disadvantage of just this sort is present under the polar opposite assumption of perfect foresight, that objective has been achieved. The present values of the profits of all brands in this sort of model are affected by the form of consumers' price expectations, but expectation formation has nothing fundamental to do with the differences between the position of the pioneering brand and those of later entrants.

V. Extensions of the Basic Model

For simplicity, this Section treats explicitly only the case of static expectations. Let us first analyze the implications of buyer uncertainty about the value of a brand that works. Consider a consumer who treats the valuation of such a brand as a random variable $v' = v + u$, where v is a constant as before and u is a random variable with mean zero and distribution function $F(u)$. Still assuming risk neutrality, and treating the value of a brand that doesn't work as non-stochastic, the condition for trial corresponding to (2) can be shown to be

$$(10a) \quad p < \underline{v}(1 - \tau) - s + z(1-\pi),$$

where z is defined by

$$(10b) \quad z = \frac{\int_{u^*}^{\infty} u dF(u) - \tau v F(u^*)}{\{1 + r - [\pi + (1-\pi)F(u^*)]\}}, \text{ and}$$

$$(10c) \quad u^* = s - (v - p).$$

The quantity z is multiplied by $(1-\pi)$ in (10a) because it picks up uncertainty about the value of a brand conditional on its working. The quantity in brackets in the denominator in (10b) is the unconditional probability that it will not be worthwhile to purchase in periods after the first; purchase of a working brand is not rational if u turns out to fall below u^* . That denominator is always positive.

If uncertainty is negligible or u^* is a very large negative number, both terms in the numerator of (10b) vanish, and $z = 0$. If the probability is one that it will be optimal to buy a working brand, condition (10) reduces to condition (2). On the other hand, if $F(u^*) = 1$, so that the prior probability that this brand is worth buying even if it works is zero, z is negative.

Consider the demand conditions facing a pioneering brand charging price p in its first period. Then (10) applies with $s = 0$ and $u^* = -(v-p)$. Suppose that $F(u)$ is the same for all consumers for simplicity. Then if the range of u is finite, there will exist a v large enough so that $F[-(v-p)] = 0$ and thus $z = 0$. The derivative of the numerator of (10b) with respect to v is

$$F'(p-v)[p - v(1-\tau)] - \tau F(p-v).$$

This is non-positive for $v \geq p/(1-\tau)$, and it is negative for some v in this interval if $F[-\tau p/(1-\tau)]$ is positive. This condition means that there is some chance that a working brand will not be repurchased: if $v = p/(1-\tau)$ and $u < -\tau p/(1-\tau)$, the consumer's actual valuation, $v' = v + u$, is less than p and purchase of the working brand is not optimal. If this condition is satisfied, it follows that z is positive in a neighborhood of the cutoff valuation under certainty, $v = p/(1-\tau)$.

Thus some consumers with expected valuations below this critical level are induced to try the product because of their uncertainty about its value to them.¹⁴ The possibility of low values of u does not offset the possibility of high values for households near the borderline. They will not repurchase the product if u is below their cutoff; whether it is barely below or far below doesn't matter.¹⁵ If realized values of u do not differ markedly from expectations, this increased propensity to experiment enhances the first brand's profitability. It will generally be possible for it to charge a price above $p/(1-\tau)$ after the first period without losing all its customers.

If trial of the first brand serves to resolve all uncertainty about the valuation of working brands in the product class considered, later entrants lose this value-of-information-based demand for trial. The gap between demands for the pioneering brand and for later entrants can thus be widened by uncertainty about the valuation of the product class.

On the other hand, if later entrants differentiate their products from the pioneering brand, they may create uncertain valuations on the

part of some consumers. This uncertainty acts as above on consumers who have not tried the first brand. For those currently buying the first brand, on the other hand, s must be set equal to $(v - P_1)$, as before, in condition (10). Thus u^* equals $-(P_1 - p)$ for all those buyers, independent of v . If $F(u^*)$ is positive, there is a positive probability that the new brand will be sufficiently worse than the old that it won't be worth purchasing even at its lower price. (By assumption, the expected valuation of the new brand equals the actual valuation of the old.) It is easy to show that if this is true, z is positive for $v = P_1$ and decreasing in v . All else equal, valuation uncertainty makes it easier for an entrant to attract at least the low- v customers of the pioneering brand; z may be negative for large enough v .

Thus if later entrants can create enough uncertainty about their value to potential users, without lowering expected valuations, they may be able to overcome their other handicaps. It is thus not surprising that the "me-too" strategy of introducing a product "just like brand X only cheaper" is apparently much less common than attempts to differentiate new products from old, to claim new features of which consumers can be expected to have uncertain valuations.

Experience with the pioneering brand, or even the observation that it remains on the market, may serve to reduce consumers' subjective probabilities that later entrant brands in the same product class won't work. This effect of course enhances the prospects of such entrants, in a continuous fashion.

Referring to Figure 2, if experience with the first brand is necessary and sufficient for greater optimism about later entrants, the $p = P_1 - \tau v$ locus that describes the introductory-period behavior of the first brand's

customers should be replaced by a line $p = P_1 - \tau''v$, with $\tau'' < \tau$. (The relevant kinked schedule then has a vertical segment at $v = P_1$.) Unless $\tau'' < (P_1/V)\tau$, later entrants still find it harder to get the first brand's customers to try their product than the first brand found it to attract them initially. Note that small drops in τ'' help later brands only slightly; the relation is continuous.

Similarly, if non-users of the first brand become more optimistic about the likelihood that brands in this class will work, the $p = (1-\tau)v$ line in Figure 2 is replaced by a steeper line with the same intercept, reflecting the lower relevant value of τ . Again, this sort of change in perceptions advantages later entrants in a continuous fashion. (If the change is sharp and quick enough, some non-users may try the first brand before others come on the market, even though it no longer charges a low introductory-period price.) Presumably this sort of second-entrant advantage is most important for "me-too" brands that do not differentiate themselves from the pioneering brand, so that this effect and valuation uncertainty are unlikely both to be important in any single situation.

The formal analysis above has neglected advertising entirely, mainly to make the point that advertising need have nothing fundamental to do with a product differentiation advantage of established firms. One could easily add to the model a requirement that all entrants pay some fixed amount to inform potential buyers of their existence and price (or price path in the case of perfect foresight). The demand handicaps facing late entrants here would then show up as lower returns on this initial advertising investment. If one added the possibility of engaging in persuasive advertising in an appropriate fashion, later entrants might find it optimal to match the price policy of the pioneering brand but to spend more on advertising

per unit of sales. As long as one follows Nelson (1974) and assumes that advertising for experience goods cannot credibly convey complete information about product quality, the addition of advertising to this model should cause no fundamental changes.

Consumers in real markets do not always rely exclusively on advertising or their own experience for information about product quality. If information about new brands is valuable enough, one can expect consumers to use word-of-mouth and other channels (specialized publications, for instance) to seek it. If a new brand is sufficiently attractive that condition (1) is satisfied and trial would be optimal, the expected value of perfect information about whether or not the product works is easily shown to be $\pi(s+p+\phi v)$. This suggests, reasonably enough, that consumers are more likely to search out additional sources of information for items with high unit cost and for those with a high subjective probability of inadequacy. The first of these factors played no role in comparisons between the pioneering brand and later entrants. Since a great deal of information transmission among consumers would undo the imperfect information on which this model's conclusions fundamentally rest, this suggests that the mechanism presented here is likely more important for products with low unit cost, all else equal.

Finally, it has been assumed throughout that trial of a new brand requires an entire period. To show that this is inessential, consider the opposite extreme case in which consumers know immediately if a new brand is bad and plan instantly to repurchase the best available substitute if a bad brand is encountered. Then (s/r) in the first term on the left of (1) would be replaced by $[(1+r)s/r]$ to reflect the planned immediate switch. This change means that (2) becomes

$$(2') \quad p \leq v(1-\tau) - s \left[\frac{(1-\pi)(1+r)}{(1-\pi)(1+r) + \pi r} \right]$$

It is messier to work with (2') than with (2), but their implications differ only quantitatively: a rise in s after trial still disadvantages late entrants.

VI. Summary and Conclusions

In this model, brands enter sequentially, and consumers are initially skeptical about their quality. When consumers become convinced that the first brand in any product class performs satisfactorily, that brand becomes the standard against which subsequent entrants are rationally judged. It thus becomes harder for later entrants to persuade consumers to invest in learning about their qualities than it was for the first brand. The demand disadvantage of late entrants is such that even if they expect the pioneering brand not to lower its price if they enter, their entry may be deterred if economies of scale are present. We have thus found a product differentiation barrier to entry that has nothing fundamental to do with advertising or consumer irrationality.

The mechanism presented here seems sufficiently general that it should be operative in most markets for experience goods. Its importance, however, can be expected to vary considerably. As Section V noted, word-of-mouth spread of quality information would seem most likely to render this mechanism unimportant for products with a high unit cost. The example considered in Section III found the second brand's disadvantage to be increasing in τ . This suggests that high risk (relative to unit cost) and low purchase frequency increase the height of the entry barrier considered here. This is consistent with the discussion of the bottled lemon juice industry in Schmalensee (1979) and with Bain's (p. 142) finding that

infrequency of purchase contributes to strong product differentiation. Finally, it is important to note that a barrier to entry arises in this framework only through interaction of late entrants' demand disadvantage and brand-specific scale economies. Bain (ch. 4) was concerned about the barrier-creating effects of economies of scale in marketing in this context, but the barrier presented here turns on overall scale economies, which clearly vary in importance across markets.¹⁶ These and related hypotheses about differences in first-entrant advantages across markets would seem to deserve some empirical attention.

If pioneering brands enjoy especially strong advantages in some set of markets, it follows that the sort of "me-too" strategy formally analyzed here is especially unattractive to potential entrants. If the products involved are such that differentiation is possible at moderate cost, it is especially likely to be attempted by new entrants. Thus, where the mechanism considered here is important, the quality-matching, price-cutting competition most commonly assumed in economic analysis is likely to be unimportant. Successful entrants will generally have differentiated themselves sufficiently from their predecessors as to appear "pioneering" to at least a sizeable segment of buyers. A mainstream industrial organization economist might be inclined to treat the product differentiation and non-price rivalry in such a market as a cause of entry barriers, but this analysis suggests that these features may be themselves caused by the same underlying basic conditions that give pioneering brands important demand advantages.

If this model captures important features of what Bain (p. 143) called "the product-differentiation problem", that problem has no easy solution. All parties here behave rationally and use as much information as they can generally be expected to have. Pioneering brands

should generally be rewarded, on average, for innovating and bearing risk. After a new and ex ante risky brand has become established, its trademark performs the valuable function of transmitting information about quality to experienced buyers, information that is not easily transmitted in other ways. By granting pioneering brands exclusive use of their trademarks forever, society grants something like a patent with infinite life. As with patent policy, trademark policy can only be analyzed in second-best terms. Like the patent grant, the potential monopoly position of pioneering brands trades off static efficiency against the incentive to innovate.

In both cases, firms may luckily reap large rewards from small risks. Situations in which pioneering brands manage to use their demand advantage to deter entry for long periods seem unlikely to have any particularly attractive optimality properties. Nothing relates the size of the risk borne to the level of the profit stream enjoyed, except possibly in some average sense. It is no easier to analyze particular proposed changes in the length or terms of the trademark grant than to perform the corresponding analyses of patent policy. As is often the case in second-best situations, decisions logically turn on very difficult questions of fact.

Such questions may only be answerable for particular industries after careful study, if even then. In any case, those concerned with antitrust or consumer information policies might check for the importance of the effect modeled here when subjecting individual markets to special scrutiny. If a product differentiation barrier based on consumers' inability to assess product quality is found in some case to be of unusual and excessive importance, novel industry-specific remedies, perhaps involving changes in the life or character of individual trademarks, might well be warranted.¹⁷ Remedies forcing or facilitating dissemination of quality information may also be attractive.

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FOOTNOTES

*Professor of Applied Economics, Sloan School of Management, Massachusetts Institute of Technology. This paper was made possible by research support from the U.S. Federal Trade Commission and made better by conversations with Steven Salop. I am grateful for both inputs, though only I can be held responsible for shortcomings of the final output.

1. William S. Comanor and Thomas A. Wilson provide a valuable survey of this literature; see also Schmalensee (1980, esp. Sect. 3).
2. See also his remarks on pages 116 and 142 and elsewhere in chapter 4.
3. For typical statements, see Kenneth Runyon (p. 214) or J. O. Peckham.
4. Christian von Weizsäcker (ch. 5) considers a basically competitive model of this sort of situation. The model of first-entrant advantages presented by Bond and Lean (1979) relies heavily on advertising. The development here traces its ancestry to the very special model in the Appendix of Schmalensee (1979).
5. Consumers are assumed not to be sufficiently clever as to infer a brand's quality from such things as its advertising level, price, or mere existence. On this sort of neglect of signalling considerations, see the discussion in Schmalensee (1978).
6. See, for instance, Avinash Dixit and the references he cites.
7. The value of quality information also encourages purchase in a more complex dynamic setting in the work of Sanford Grossman, Richard Kihlstrom, and Leonard Mirman. See also the discussion of uncertain values in Section V, below.
8. If $C[Q]$ is the total cost function, we have $\Pi(p) = pQ(p) - C[Q(p)]$, and $\Pi^0(p) = pQ[p/(1-\tau)] - C[Q(p/[1-\tau])]$. The first assertion in the text follows from inspection, the second follows from inspection

of the first derivatives of these functions and the assumption of strict concavity.

9. Joel Dean provides a brief discussion and a comparison with the alternative high/low strategy usually called "cream-skimming". The proof below that a Q-constant, penetration pricing strategy is optimal here seems to depend heavily on the basic non-durability of the product considered. Cream-skimming uses durability to separate markets in different periods so that intertemporal price discrimination can exploit either consumers' tendency to underestimate future price declines or, under perfect foresight, differences among buyers' intertemporal preference structures: compare Karl Löfren and Nancy Stokey.
10. If price changes only a finite number of times and the final change is to a price less than $\underline{P}/(1-\tau)$, profits can be increased by charging $\underline{P}/(1-\tau)$ instead of that final price. If it is optimal to change price an infinite number of times, stationarity implies that price is monotone decreasing tending toward some non-negative limit, call it $P^\infty(1-\tau)$. Then per-period profit approaches $\pi'[P^\infty(1-\tau)] \leq \pi(P^\infty)$, with equality holding if and only if $P^\infty = 0$. If $P^\infty \leq P^*$, such a sequence is dominated by one that involves increasing price to P^* as soon as a price below $P^*(1-\tau)$ is charged in the original sequence. If $P^\infty > P^*$, the uniqueness of P^* implies that one can find $P' > P^\infty$ such that $\pi(P^\infty) > \pi(P') > \pi'[P^\infty(1-\tau)]$, and profit can be increased by charging P' for all periods after the original price sequence drops below $P'(1-\tau)$. Thus it cannot be optimal to change price infinitely often.

11. If the first brand has followed a monopoly Q-constant policy, P_1 exceeds the static, perfect information monopoly price, as Section II noted. Thus marginal revenue just to the right of point A in Figure 3 exceeds the first brand's equilibrium marginal cost. If the second brand's marginal cost at the relevant output is no larger, some equilibrium sales to new customers may thus be optimal.
12. Kent Monroe surveys the extensive literature on the use of price as an indicator of quality.
13. Based on the analysis of Stokey and the results in Section II, above, I conjecture that a strategy of this form is in fact optimal here, but I have not proven this to be true. Note that if $p^0 > p$, some consumers may rationally wait until the second period to buy.
14. If consumers were risk-averse, this might well be reversed; see the Appendix to Schmalensee (1979).
15. The analogy to valuation of stock options is immediate. Here as there, only one tail of the relevant distribution matters, so that increases in variance, all else equal, tend to enhance value. Mark Rubinstein and John Cox provide a clear and thorough discussion of option valuation.
16. Michael Spence provides a useful analysis of the interaction of scale economies in production and promotion.
17. Such a remedy was ordered by a Federal Trade Commission administrative law judge in the ReaLemon case but rejected by the Commission on appeal; see Schmalensee (1979) for an economic analysis of the case.

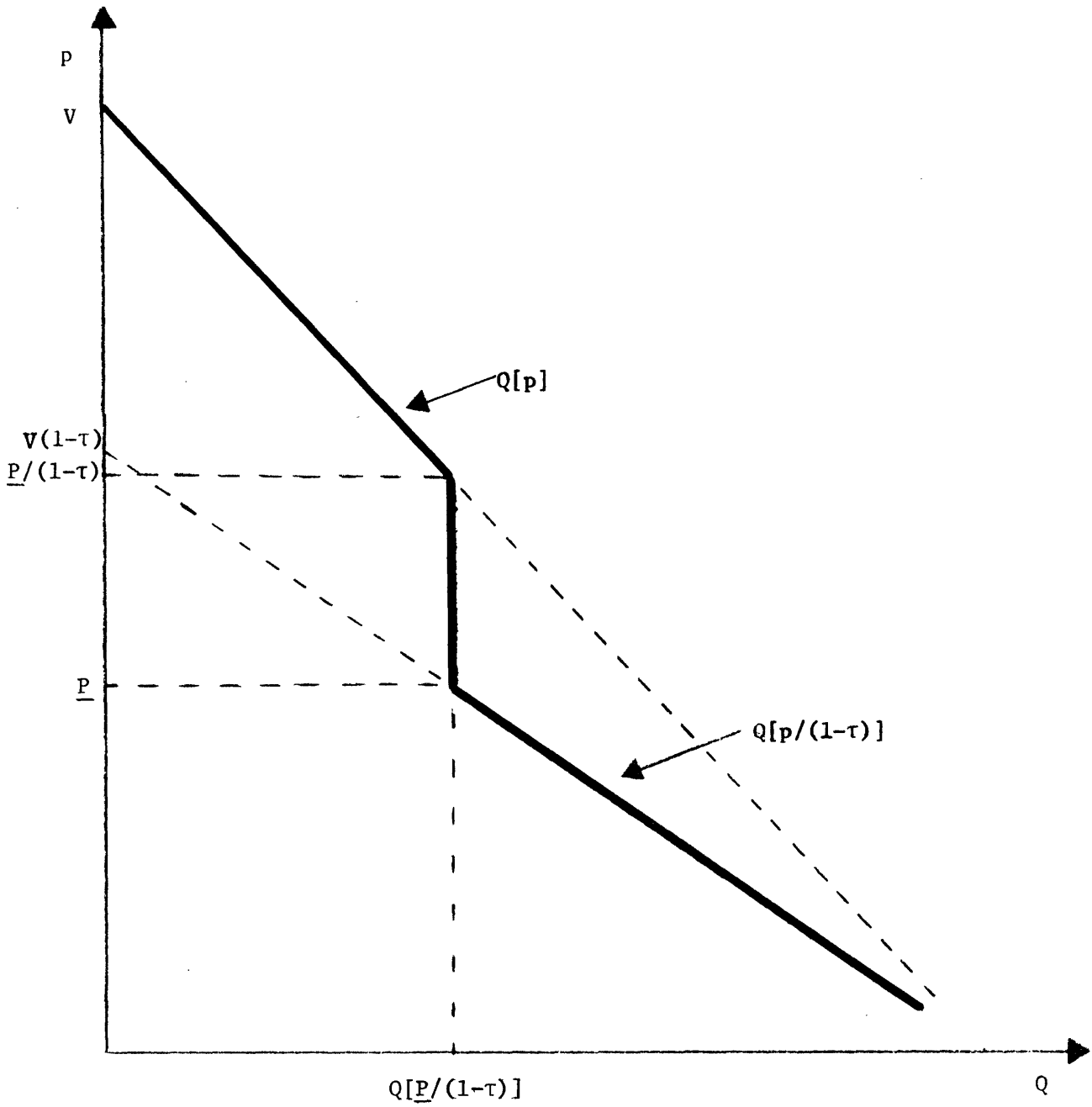


Figure 1

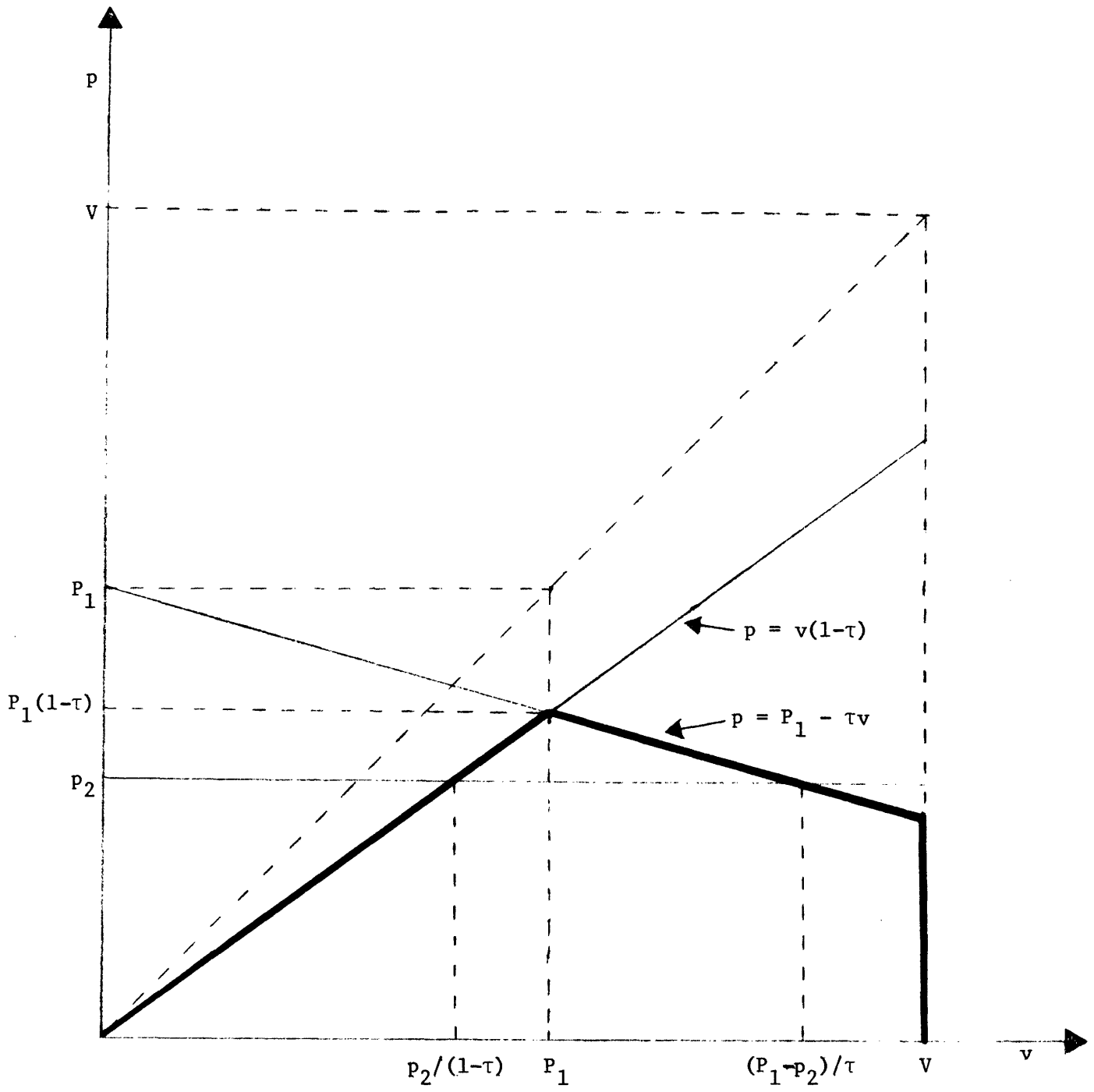


Figure 2

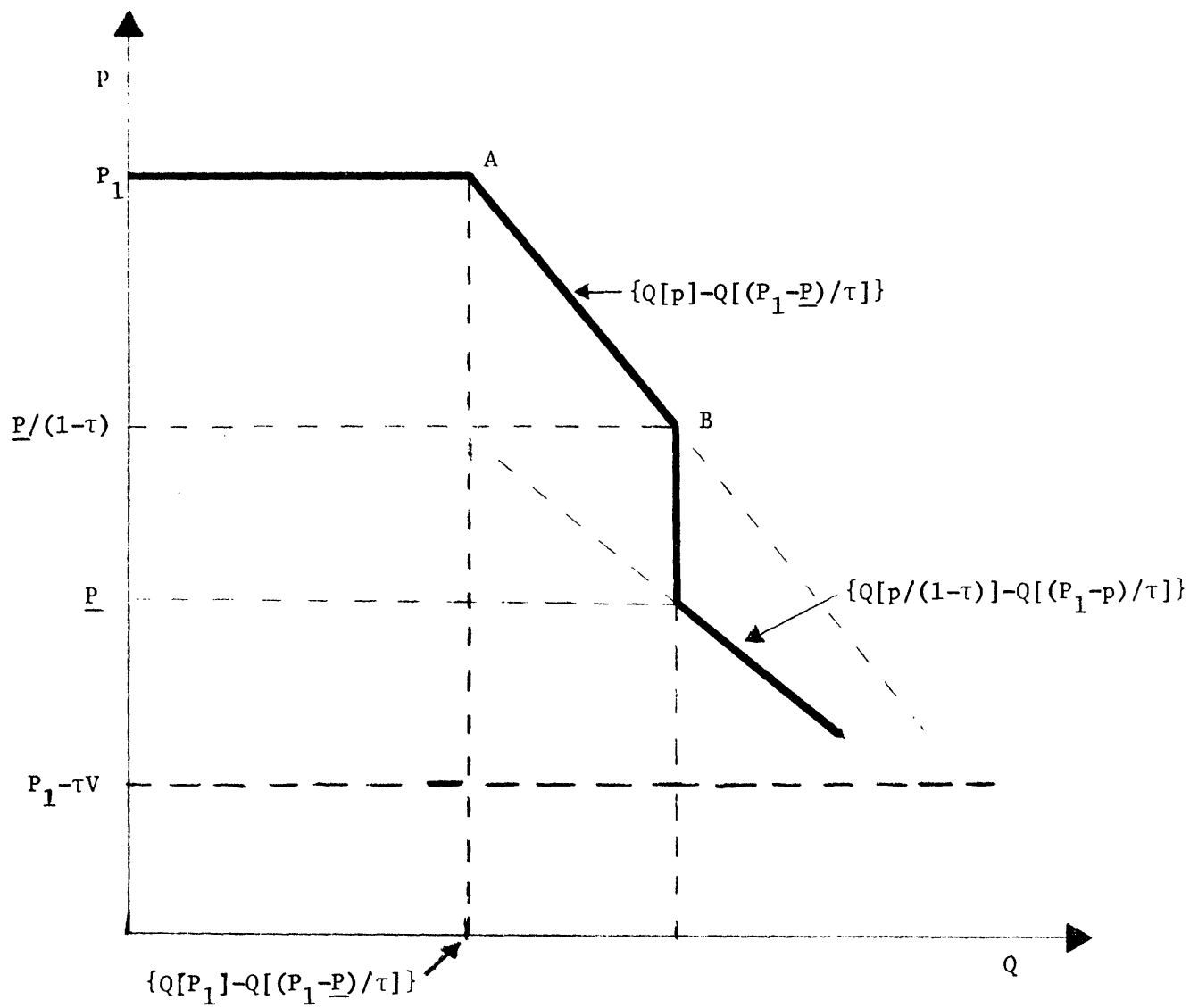


Figure 3