Monopoly versus Competitive Leveraging of Reputation through Umbrella Pricing

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Umbrella Branding

First question: Why do brand names matter anyway?

The main and easy answer is that some firms simply have committed to a technology that produces high-quality products. Adverse selection models.

Another answer is reputation. Moral hazard models. Klein-Leffler (1981). Anderssen (2002).

Market Structure

This has received much less attention. How would umbrella branding work in competitive markets? Reputation works in competitive markets. How about umbrella branding based on reputation?

Could umbrella branding be used as a tool to leverage monopoly power in one market into another?

The Model

One or more firms produce a single good, which has either low or high quality. Each firm chooses its own quality anew each period. All firms have a marginal cost of c for the low-quality version of the product and $(1+\gamma)c$ for the high quality version, with $\gamma > 0$.

We will look at both monopoly and competition. In the monopoly case, the monopolist chooses the price. In the competitive case, a unit interval continuum of firms engage in Bertrand price competition.

Consumers lie on a continuum of length x. Consumers are identical. Each wishes to buy one unit of the good and is willing to pay up to v for low quality or $(1+\theta)v$ for high quality, with $\theta > \gamma$.

A firm's quality in a given period is unobservable before purchase, but becomes common knowledge after purchase. The discount rate is r, payments occur at the end of periods, and there are an infinite number of periods.

At the start of a period, firms choose prices and qualities.

Consumers then decide whether and where to buy.

An interval of time passes, and at the end of the period firms pay the cost of production, consumers pay the firms, receive the product, and everyone learns the quality the products that were purchased.

The next period then begins with new decisions by firms about prices and qualities.

Assume

$$(1+\theta)v - (1+\gamma)c > 0, \tag{1}$$

which says that purchasing a high-quality product at cost is better for the consumer than not buying at all.

If $v > c$ we will say that low quality is viable: it is more efficient for consumers to buy low quality than not to buy at all. If $v < c$ we will say that low quality is unviable.

These assumptions imply that high quality is efficient. High quality's consumer surplus is higher than low quality's if

$$(1+\theta)v - (1+\gamma)c > v - c. \tag{2}$$

If $v - c > 0$, then inequality (2) is implied by our assumption that $\theta > \gamma$. If $v - c < 0$, then (2) is also true, because its left-hand-side is positive by assumption (1) and its right-hand-side is negative.

The pessimistic equilibrium.

Firms produce low quality and charge $p = c$ if the industry is competitive and $p = v$ if it is monopolized.

Consumers purchase at the lowest available price if it is less than v and do not purchase otherwise.

If a firm deviates from equilibrium, consumers still believe it will produce low quality in the future.

The optimistic equilibrium.

Firms produce high quality unless they have ever produced low quality, in which case they produce low quality.

In a competitive market the equilibrium price is $p = c+(1+r)\gamma c$, and in a monopolized market it is $p = (1+\theta)v$.

If consumers believe the quality is high, they purchase at the lowest available price if it is less than $(1+\theta)v$ and do not purchase at all otherwise.

If consumers believe the quality is low, they purchase at the lowest available price if it is less than v and do not purchase at all otherwise. Out-of-equilibrium, if consumers observe a firm charging less than the equilibrium price, they believe it has chosen low quality; otherwise, they believe it has chosen high quality.

The Equilibrium in a Competitive Industry

The pessimistic equilibrium is simply repetition of the one-shot game's equilibrium. If $v > c$, so low quality is viable, firms produce quantity x with low quality and charges $p = v$ because low quality is less costly for them to produce and a deviation to high quality would not affect consumer beliefs. If $v < c$, no trade at all takes place, since consumers are unwilling to pay even the cost of a low-quality good.

In the optimistic equilibrium, the price exceeds marginal cost, because sellers require an inducement to forgo earning short-term profits by producing low quality. Let us call the minimum necessary price that makes high quality a possible equilibrium outcome the "Klein-Leffler price" and denote it by p^*. This price will equal

$$p^* = c(1+\gamma) + r\gamma c = c + (1+r)\gamma c. \tag{3}$$

The Klein- Leffler price equates

$$\pi(high\ quality) = \frac{(p - c(1+\gamma))x}{r}, \tag{4}$$

with

$$\frac{(p-c)x}{1+r}. \tag{5}$$

For the optimistic equilibrium to exist requires that consumer prefer buying a product believed to be high quality at price p^* instead of a product believed to be low quality at price c, its cost.

Consumer surplus from the high-quality good is

$$(1+\theta)v - p^* = (1+\theta)v - [c(1+\gamma) + r\gamma c]. \tag{6}$$

Consumer surplus from the low-quality good priced at marginal cost is $v - c$. We need

$$(1+\theta)v - [c(1+\gamma) + r\gamma c] > v - c. \tag{7}$$

We need:

$$\theta v \geq (1+r)\gamma c. \tag{8}$$

Let us now check that no player would wish to deviate from the optimistic equilibrium.

In equilibrium, the consumer's strategy is to believe the product is high quality unless some firm has already deviated, and to buy the product from the cheapest firm whose price is between p^* and $(1+\theta)v$.

If the consumer observes a firm with price less than p^*, he will not buy from that firm, because his out-of-equilibrium belief is that the product's quality is low, and the viability condition (5) tells us that his payoff is higher from buying high quality at p^*. Thus, no consumer will deviate.

Firms charge p^* in equilibrium and earn the payoff in equation (4) because the quantity demanded, x, is split evenly across the unit interval of firms.

Any firm that deviated to a higher price would sell nothing in that period, and so would reduce its payoff.

Any firm that deviated to a lower price would be believed to have low quality in that period and thereafter.

This is dominated by charging p^* and deviating to low quality. In subsequent periods, when the firm is believed to produce low quality, it is clear no consumer will buy if $v < c$. If $v > c$, a consumer could earn surplus buy buying low quality, but the viability condition (5) tells us that buying high quality at p^* is preferable. Thus, no firm will deviate.

Even though firms are competitive they earn positive profit.

There exist other high-quality equilibria in this game if we change the out-of-equilibrium beliefs.

E.g.: The belief that if firms deviate to charge less than p' they have produced low quality, where $p' > p^*$ is a price such that consumers still prefer buying high quality to buying low at marginal cost.

This kind of belief can be ruled out by an equilibrium dominance argument: since the deviating firm would reduce its payoff by deviating from p' and high quality to p^* and low quality, but would increase its payoff if it deviated to p^* and high quality and consumers believed the quality was high, consumers should adopt the second belief.

The Equilibrium for a Monopoly

The pessimistic equilibrium is much like in the competitive case.

In the optimistic equlibrium, if $v < c$ then the "monopoly Klein-Leffler price," $p^*(monopoly)$, will equal the competitive Klein-Leffler price p^*, because deviation profits are the same as for a competitive industry.

If $v > c$, on the other hand, consumers will continue to buy even if they expect low quality.

The monopolist's profit from deviating to low quality then has two parts, the one-time large gain from when consumers are fooled into paying the high-quality price and a steady stream thereafter of positive though lower profits from charging v for low quality. The monopoly's payoff is

$$\pi(low\ quality, monopoly) = \frac{(p-c)x}{1+r} + \frac{(v-c)x}{(1+r)r}. \tag{9}$$

The incentive compatibility constraint for the firm is

$$\frac{(p-(1+\gamma)c)x}{r} \geq \frac{(p-c)x}{1+r} + \frac{(v-c)x}{(1+r)r}. \tag{10}$$

Solving, and combining with the $v < c$ case:

$$\begin{aligned} p^*(monopoly) &= v + (1+r)\gamma c & if\ v > c \\ &= c + (1+r)\gamma c = p^*(competitive) & if\ v < c \end{aligned} \tag{11}$$

When $v > c$ the monopoly Klein-Leffler price is greater than the competitive Klein-Leffler price.

One might think that this means that there exist parameter values for the quality premium θ high enough for high quality to be viable for a competitive industry but not for a monopoly. That is false, as Proposition 1 tells us.

Proposition 1: *Whenever parameter values make high quality viable under competition they also make it viable under monopoly.*

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Proof. If $v < c$ then the Klein-Leffler price is the same for the monopoly and the competitive industry, so the proposition is obvious.

For high quality to be viable in a competitive market when $v \geq c$ requires that

$$\theta v \geq (1 + r)\gamma c.$$

Is the consumer willing to pay $p^*(monopoly)$ instead of buying nothing?

$$(1 + \theta)v \geq p^*(monopoly) = v + \gamma(1 + r)c. \tag{12}$$

Inequality (12) is true if and only if

$$\theta v \geq (1 + r)\gamma c, \tag{13}$$

The quality-guaranteeing price is higher for the monopolist.

Yet the viability problem of that price being so high that no equilibrium with high quality exists is no more severe than for a competitive industry. Why?

The reason is that the most tempting deviation has a different character for the monopoly. For the monopoly, what matters is whether the firm is tempted to deviate to low quality to obtain a one-time gain and then begin selling low quality at a low but profitable price. For the competitive industry, that is not the binding constraint. Rather, what matters is whether *consumers* would switch from a firm selling high quality at p^* to a firm selling low quality at c. Thus, we cannot simply compare the quality-guaranteeing prices in the two industry structures.

That explanation, however, leaves us with the puzzle as to why two such different constraints yield exactly the same parameter range for viability. The monopoly is comparing high quality's steady profit flow to the combination of a one time windfall profit plus low quality's steady flow. In the competitive industry, consumers are comparing the utility flows from high quality and from low quality— different players, and different kinds of payoff streams. The resolution to that puzzle is that in the competitive industry, the high, quality-guaranteeing price yields a profit flow to a firm that has a capitalized value equal to the one-time gain from deviating to low quality. The monopoly compares the capitalized value of the high-quality social surplus (call it X) to the combination of the low-quality social surplus (Y) plus the one time gain from cheating (Z), to see if $X > Y + Z$. The consumers compare the capitalized value of the high-quality social surplus (X) minus the capitalized value of the steady quality-guaranteeing price premium (which equals the one-time gain from cheating, Z) to the social surplus from low quality (Y), to see if $X - Z > Y$. The inequalities end up being equivalent.

Observation 1. *Suppose a competitive market is viable for low quality but not for high quality. If the the low-quality product becomes worse (v falls) while the high-quality product does not ($(1 + \theta)v$ stays the same) social welfare can rise because high quality may become viable.*

Proof. Return to the viability condition in (7):

$$(1+\theta)v - [c(1+\gamma) + r\gamma c] > v - c.$$

If this inequality is false, so high quality is not viable, then it can be made true if the value of the low-quality product, v on the right-hand-side, can be reduced while keeping the value of the high-quality product on the left-hand-side, $(1+\theta)v$, constant.

This unilateral worsening of the value of low quality is to be interpreted as a simultaneous reduction in v and an increase in θ that keeps $(1+\theta)v$ unchanged.

Both a competitive and a monopolistic industry would increase profits by making high quality viable in this way, and social surplus would rise.

In the competitive industry, consumers would have positive payoffs even in the pessimistic equilibrium if low quality is viable. Worsening the low-quality product could eliminate any surplus from it while reducing p^* to just slightly below $(1 + \theta)v$, the consumer's value.

In the monopoly case, consumers earn zero surplus in either the pessimistic or the optimistic equilibrium, so the product-worsening strategy would affect only the firm.

In the competitive industry, this w producer and consumer surplus because producers would start to earn the rents necessary to make a reputation valuable while consumers would be buying the high-quality good at less than their reservation value, though in the monopoly consumer welfare would be left unaffected.

Observation 2. If the monopolized market is unviable for high quality, the monopolist may be able to profitably make it viable by allowing free entry into production of the low-quality good.

Proof. We start with the premise that $v > c$. The monopolist's quality-guaranteeing price is $p^* = v + (1 + r)\gamma c$ when $v > c$, which was derived by comparing the profits from high quality with the profits from deviating to permanently selling low quality. The quality-guaranteeing price derived by deviating to not producing at all after the period of cheating was $p^* = c(1 + \gamma) + r\gamma c$, which is lower because $v > c$. This was derived for the case of $v < c$, but it applies equally well if permanent deviation profits are zero because the low-quality market is competitive. Thus, by making the low-quality market competitive, the monopolist is able to credibly promise high quality at a lower price than before.

We must still ask whether the monopolist's profits are higher after switching to high quality.

The monopolist was earning positive profits before the switch, and the fact that social surplus rises with is not determinative because the monopolist does not obtain the entire social surplus.

It must face competition from low-quality firms charging $c < v$ for an item with value v, so it cannot take away all the consumer surplus by setting the high-quality price at $(1+\theta)v$. Rather, the monopolist's price p must make the consumers indifferent between its high quality and the competitive low quality, so

$$(1+\theta)v - p \geq v - c, \tag{14}$$

and $p = c + \theta v$.

Skipping many steps, it turns out that what is needed is $r\gamma c > v - c$.

Umbrella Pricing: Monopoly

We will now let there be two products, subscripted i, with possibly differing parameters v_i, γ_i, θ_i, c_i, and x_i, $i = 1, 2$. Firms choose the quality of each product separately. We will use K_i as an indicator variable, where $K_i = 1$ if $v_i \geq c_i$ so that low quality for product i is viable, and $K_i = 0$ if $v_i < c_i$.

If both products are viable, a monopoly will sell them at prices $(1+\theta_1)v_1$ and $(1+\theta_2)v_2$ for high quality. It cannot do better by using cross-subsidization. If neither is viable, the firm would sell either nothing or low quality.

Suppose next that high quality for product 1 is strictly viable but for product 2 it is unviable. This means that

$$(1+\theta_1)v_1 > p_1^*(monopoly) = c_1 + (1+r)\gamma c_1 + K_1(v_1 - c_1) \tag{15}$$

and

$$(1+\theta_2)v_2 < p_2^*(monopoly) = c_2 + (1+r)\gamma c_2 + K_2(v_2 - c_2) \tag{16}$$

Note that if $K_i = 0$ then the monopoly Klein-Leffler price is $c_i + (1+r)\gamma c_i$,while if $K_i = 1$ it is $v_i + (1+r)\gamma c_i$, as we found earlier in the single-product model.

A two-product monopolist might be able to produce both products at high quality, however, if consumers believe that a deviation to low quality for product 2 implies the firm will produce low quality for product 1 in the future also. We will call these "umbrella beliefs."

Proposition 2: *A monopoly selling two products can for some parameter values maintain high quality for each when two monopolies each selling one product cannot.*

Proof. The two-product monopolist's post-entry profit from producing both products with high quality is

$$\frac{((1+\theta_1)v_1-(1+\gamma_1)c_1)x_1}{r}+\frac{(p_2-(1+\gamma_2)c_2)x_2}{r}, \tag{17}$$

where product 1 is sold at the high-quality monopoly price and product 2 is sold at some price p_2 as yet unspecified. The most profitable deviation payoff is from deviating to low quality for both products for one period and then continuing to sell with low quality in any market for which low quality is viable. Thus, the payoff for each product is composed of one term for the profits from the one opportunistic period plus a second term for the profits from succeeding periods if low quality is viable for that product.

$$\frac{((1+\theta_1)v_1-c_1)x_1}{1+r}+(K_1x_1)\frac{1}{1+r}\frac{v_1-c_1}{r}+\frac{(p_2-c_2)x_2}{1+r}+(K_2x_2)\frac{1}{1+r}\frac{v_2-c_2}{r}. \tag{18}$$

The profit from high quality is at least as high as from deviation if expression (20) is greater than expression (21), so p_2 must at least equal the critical price $\tilde{p_2}$ that solves the last equation as an equality, a price that is always less than the stand-alone monopoly Klein-Leffler price $p_2^*(monopoly)$:

$$\tilde{p_2} = [1 + (1 + r)\gamma_2]c_2 - K_2(v_2 - c_2) - \left(\frac{x_1}{x_2}\right)\left((1 + \theta_1)v_1 - (1 + (1 + r)\gamma_1)c_1 - K_1(v_1 - c_1)\right) \quad (19)$$

$$\tilde{p_2} = [1 + (1+r)\gamma_2]c_2 - K_2(v_2 - c_2) - \left(\frac{x_1}{x_2}\right) \Big((1+\theta_1)v_1 - (1 + (1+r)\gamma_1)c_1 - K_1(v_1 - c_1)$$

The question is whether $\tilde{p_2} < p_2^*(monopoly)$.

The stand-alone monopoly price is $p_2^*(monopoly) = c_2 + (1+r)\gamma c_2 + K_2(v_2 - c_2)$ from equation (19). Thus, what must be shown is that the term multiplied by x_1/x_1 is positive. It is because that is directly implied by product 1's viability condition in equation (18).

What makes umbrella pricing helpful is first the lack of viability of high quality for product 2. If high quality is already viable in market 2, then the price immediately rises to the reservation price of high quality, $p_2 = (1+\theta_2)v_2$, and nothing further can be done by umbrella pricing. If high quality is not viable for product 2, then umbrella pricing can help. Equation (22) tells us that it is particularly likely to help if θ_1, and x_1 are high relative to the other parameter values, and if r and γ_1 are low. In words, what makes umbrella pricing most useful is when high quality is particularly important to product 1 and its market is large, and when the discount rate and the cost of high quality are low. Then, the total profit from selling high-quality product 1 is particularly high relative to profits from low quality, removing the temptation to to sacrifice that profit for the one-time gain from cheating. Product 1's profit can be used as a hostage to ensure that the two-product monopolist does not cheat and sell low quality for product 2.

Umbrella branding is that it not only makes product 2 viable; it does so without requiring the firm to sacrifice any profits whatsoever from product 1.

Umbrella Pricing in a Competitive Industry

A firm's post-entry profit from producing two products of high quality is

$$\frac{(p_1-(1+\gamma_1)c_1)x_1}{r}+\frac{(p_2-(1+\gamma_2))x_2}{r} \tag{20}$$

compared with a deviation payoff of

$$\frac{(p_1-(1+\gamma_1)c_1)x_1}{1+r}+\frac{(p_2-(1+\gamma_2)c_2)x_2}{1+r} \tag{21}$$

These are equated by the same values of p_1^* and p_2^* as when firms sell individual products.

The two payoffs are also equated by many other price pairs. Would any of those support an equilibrium? No. Any other price pair would require not just umbrella beliefs but also that $p_1 > p_1^*$ and $p_2 < p_2^*$.

If product 1 is viable but product 2 is unviable, umbrella pricing will not extend viability to product 2, unlike in a monopoly market. Firms do not have "redundant" profits from product 1 that they can put at risk to give themselves an incentive for high quality from product 2.

Proposition 3: *A competitive industry made up of firms selling two products cannot maintain high quality if an industry of firms selling one product each could not.*

Proposition 3 does depend crucially on competitive firms competing the price down to the Klein-Leffler levels in equilibrium.

Leveraging Monopoly Power Using Umbrella Pricing

Let there be 2 monopolies and 3 products, all strictly viable, with demand and cost parameters v_i, γ_i, θ_i, c_i, and x_i, $i = 1, 2, 3$. Monopoly 1 and monopoly 2 are the only possible producers of products 1 and 2, while product 3 can be produced at the same cost by both those two firms and by many other competitive firms. This will allow us compare not just competition between a competitive industry and a monopoly but between two monopolies. We will assume, to reduce clutter, that $v_1 < c_1$ and $v_2 < c_2$), so low quality is not viable for products 1 and 2.

The quality-guaranteeing price for product 3 will be different for monopoly 1, monopoly 2, and the competitive firms. Thus, let us clarify the out-of-equilibrium beliefs being assumed. On observing an out-of-equilibrium price, onsumers believe a firm chose low quality if its price is below the quality-guaranteeing price p^* *for that firm* and high quality otherwise.

If the monopolies are not allowed to sell product 3, the market prices are, from (3),

$$
\begin{aligned}
p_1 &= (1+\theta_1)v_1 \\
p_2 &= (1+\theta_2)v_2 \\
p_3 &= p_3^*(competitive) \;=\; c_3 + (1+r)\gamma_3 c_3
\end{aligned}
\tag{22}
$$

What if monopoly 1, but not monopoly 2 is allowed to sell product 3? Equate the profit from high quality,

$$\frac{((1+\theta_1)v_1-(1+\gamma_1)c_1)x_1}{r}+\frac{(p_3-(1+\gamma_3)c_3)x_3}{r} \tag{23}$$

to the profit from low quality,

$$\frac{((1+\theta_1)v_1-c_1)x_1}{1+r}+\frac{(p_3-c_3)x_3}{1+r}. \tag{24}$$

Equating yields

$$\begin{aligned} p_3^*(Mon.\ 1) &= (1+\gamma_3)c_3+r\gamma_3c_3-\tfrac{[(1+\theta_1)v_1-(1+(1+r)\gamma_1)c_1]x_1}{x_3} \\ &= p_3^*-\tfrac{[(1+\theta_1)v_1-(1+(1+r)\gamma_1)c_1]x_1}{x_3} \end{aligned} \tag{25}$$

Now open up product 3 to sales by monopoly 2.

By the same reasoning as for monopoly 1, $p_3^*(Mon.2) < p_3^*$.

Suppose that $p_3^*(Mon.2) < p_3^*(Mon.1)$, as would be the case if the cost of product 2 were lower, or its reservation price higher, or its market bigger.

Then in the price competition between monopolies 1 and 2, monopoly 2 will capture the entire market for product 3, at price $p_3^*(Mon.1)$, the price below which monopoly 1 cannot cut.

Proposition 4: Suppose one product can be produced by only one firm but a second product can be produced by many firms. If the monopoly is allowed to produce both products, it will capture both markets. If a firm with a monopoly on some third product also tries to sell in the competitive market, competition between the two monopolies will result in monopoly leveraging that helps consumers.

This kind of monopoly leveraging is distinguishable from improper leveraging in two ways.

First, it does not involve any kind of complex contract that ties the two markets together, unlike bundling or exclusive dealing.

Second, the monopoly does not charge less than the cost of the competitive firms.

The intuition is easy to extend to a market in which high quality is not viable but in which consumers are willing to buy even low quality if necessary $(v > c)$. In that case, if its reputation in the initially monopolized market is a sufficiently valuable bond, an umbrella-pricing monopolist could enter with high quality and capture the market even if its price were higher than what the competitive firms were charging for low quality.

Whinston (1990). Goods A and B each have consumer reservation prices of 8 and are monopolized by a firm that has marginal cost of 5 for each of them.

A new firm with a marginal cost of 3 and entry cost 1 appears for B.

If the monopolist sells the two goods separately, the new firm will enter.

If the monopoly commits to tying sales of A and B and charges a price of 16 for the bundle instead of 8 for each, it is safe from entry.

If the new firm enters, the monopolist would be willing to let the bundle's price drop to 10.9, leaving consumers with a surplus of 5.1 which is greater than the 5 they could get by buying only good B from the new firm.

The monopolist is willing to do this, because his payoff is still .9. better than the 0 he would get by losing the sale.

The monopolist purposely puts its monopoly profits at risk to block competition in a second market.

In the Whinston model, however, the monopolist succeeds because it has increased potential price-cutting off the equilibrium path.

In the umbrella model, the monopolist succeeds because it has reduced potential quality-cheating off the equilibrium path in a way that competitive firms cannot match.