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Advertising, Competition, and Brand Names

Many of the most memorable advertising campaigns promote a brand by emphasizing that it is different in some way from other leading brands in the market. The soft drink 7-Up was long touted as the Uncola Drink. Kellogg's Sugar-Frosted Flakes are uniquely identified with Tony the Tiger and his testimony that this cereal is Grrr-Great. Perhaps most famous of all is Coca-Cola's claim that "Coke is the real thing." These and other campaigns for countless other products tell consumers that the advertised brand is special and different from all others. Of course, sometimes the differences emphasized by the ads are real. Apple Computer does in fact offer a different product from Windows-operated PCs. Likewise, Apple's iPhone is different from most others. When the product differences across the brands are important to consumers, advertising can play an important and useful role in matching consumers to the brand that they prefer.

However, when the different brands of products do not appear to be actually very different, advertising by competing brands turns into a "capture-the-consumer" game. As such it has the potential to become a form of wasteful competition. The advertising expenditure on product promotions yields little useful information to consumers. This may be the case when it appears that it is advertising itself that is the chief source of differences among the brands.

In this chapter, we consider the role that advertising can play when, in contrast to the previous chapter, there are many firms competing for customers. Advertising and the creation of brand names are important strategies for a firm. When consumers have a preference for variety and product differentiation is important to them the creation of brand names can play an important matching role—directing consumers to the products that they prefer. Advertising is a key part of developing and promoting brand names. On the other hand advertising can yield little additional information and be both wasteful and harmful to consumers. Which outcome obtains will depend on how one thinks advertising works when employed as a strategy by rival firms. This issue is the central focus of this chapter.

21.1 ADVERTISING AS WASTEFUL COMPETITION

One concern about advertising is that it allows firms a way to differentiate their products in the minds of consumers and thereby soften price competition. In other words, there is again the fear that advertising confers or strengthens monopoly power. There is added concern that advertising could be socially inefficient in markets with strategic interaction. Advertising

expenditures in such markets may simply be a form of wasteful competition that does not even increase firm profitability.

This insight can be easily illustrated by means of a simple game. Suppose that ZIP Studios and Gamma Studios are both in the entertainment industry and they compete for customers of their films through advertising. The profit of each company depends on both its own advertising expenditure as well as that of its rival. To be specific, suppose that the profits of each studio are as follows:

$$\begin{aligned} &\text{ZIP profit} = (60 - A_G)A_Z - A_Z^2 \\ &\text{Gamma profit} = (60 - A_Z)A_G - A_G^2 \end{aligned} \tag{21.1}$$

where A_Z and A_G are the advertising expenditures of ZIP and Gamma, respectively. Each studio company seeks to maximize its profit through its choice of advertising expenditure. This leads to the following advertising best response functions:

$$\begin{aligned} &R^Z\text{: } A_Z = 30 - A_G/2 \\ &R^G\text{: } A_G = 30 - A_Z/2 \end{aligned} \tag{21.2}$$

Reality Checkpoint

The Brush War in Hog Heaven

One of the classic examples of a "prisoners' dilemma" advertising war comes from the rivalry between Braun (owned by Gillette) and Optiva (owned by Philips), the two biggest makers of electric toothbrushes. For years, the two firms have engaged in a "no holds barred" public relations battle that has become the stuff of advertising legends. Each side has taken extreme measures to convince both households and dentists that its brush is the best.

One of the most extraordinary rounds in this ongoing fight occurred in late 1999. Optiva was then vigorously pursuing market share for its Sonicare brand. To this end, it conducted a number of tests that purported to show that Sonicare toothbrushes were both less abrasive to tooth enamel and far better at attacking bacteria below the gumline than Braun's Oral B Plaque Remover model. Many of these tests were done by a team of researchers under the direction of a Swiss dental scientist. The team compared the two brushes by repeatedly brushing the teeth of 3,000 dead pigs. This was quite expensive. It required the purchase of the pig heads from slaughterhouses and then arranging for the transportation and refrigeration of those heads in storage. Further expenses were necessary to ensure that the tests were completed quickly before decay set in.

The response from Braun was quick and forceful. It sent a team of scientists The whole affair was very expensive. In truth, it is hard to know how relevant the brushing of pigs' teeth is to human oral hygiene. Moreover, the resultant claims and counterclaims it ultimately led to a court battle—one of many that the two firms have fought. No doubt, both sides would have liked to have had a ceasefire and avoid these costs. Yet that is precisely the conundrum of the prisoners' dilemma. Each firm finds it difficult to stop its aggressive behavior unilaterally so, the advertising war and its associated expense continue. It seems probable though that these tests are done for purely promotional reasons and involve little gain for consumers. Since they also appear to be jointly unprofitable for producers, the advertising expenses must be considered largely wasteful—that is, unless one thinks that a hog's healthy smile is worth a lot, even if the hog is dead.

Source: M. Maremount, "Braun, Sonicare Brush Up on Their Legendary Feud," *Wall Street Journal*, April 30, 1999, p. A1.

Simple algebra confirms that the Nash equilibrium, that is, a pair of best responses for this game, is $A_Z^* = A_G^* = \$20$. Total advertising expenditure in the industry is \$40 and each studio earns a profit of \$400. However, it is also easy to show that each studio would be better off if they both advertised less. Specifically, the joint profit of the two firms is maximized when $A_Z = A_G = \$15$. In that case, total advertising in the industry reduced to \$30 and each studio earns a profit of \$450.

The problem is that the two studios are caught in a "prisoners' dilemma" game spending extra resources on advertising in a futile struggle to steal consumers from each other. If advertising does not bring in additional consumers to the market, then the loss in producer surplus that results from this dilemma is not counterbalanced by any gain in surplus. Instead, each studio is led to advertise so as to avoid being the loser whose customers will be lured to the rival. However, the net result of such spending in total is that each studio ends up with basically the same number of customers it would have had if it and its rival had agreed not to advertise.

21.2 ADVERTISING AND INFORMATION IN PRODUCT-DIFFERENTIATED MARKETS

When the differences among the products sold in a market are relatively small, advertising strategies are often used to play a capture the consumer game, and as such can lead to wasteful competition. However the game changes when the products marketed are different in some key dimension that is important to consumers. In this case advertising can play an important information role—matching consumers to brands. To investigate the role and impact of advertising in this context, we of course need to work in a setting of differentiated products, such as the now familiar Hotelling model of spatial competition. The set of different kinds of products potentially available is described by a unit line segment. Each point on the line represents a potential brand or variety of product. The total population of consumers in this market, again denoted by N, is uniformly distributed along the line. Each consumer is identified by a point on the line that corresponds to that consumer's most preferred version of the product. A consumer wants to buy at most one unit of the product and is willing to pay up to V for her most preferred brand.

Let us work out first the benchmark case when consumers are perfectly informed about products and there is no advertising in the market. If the consumer's most preferred brand is not being offered for sale, then the consumer must decide whether or not to purchase another brand at some distance x along the line from her most preferred brand. The consumer's willingness to pay for a brand at a distance x from her most preferred brand is $V - tx$, where the parameter t is, as usual, the cost incurred by the consumer per unit distance she travels from her most preferred brand. As t increases, consumer tastes in this market become more specialized. A high value of t implies that a consumer incurs a large cost when forced to buy a brand even a short distance removed from her most preferred type. In this case, we would regard consumer tastes to be very specialized. The preference for specialized varieties of goods is strong.

We assume that there are two firms, each located at the opposite ends of the line. Firm X markets brand x and is located at point 0, the leftmost or farthest westward location. Firm Y markets brand y and is located at point 1, the rightmost or most eastern end of the line. The unit cost of production of each brand, denoted by c, is constant and the same for the two firms. The benchmark model is one in which consumers are *perfectly informed* about

the exact locations (i.e., characteristics) of the two brands and their prices, p_x and p_y. The decision of a consumer in this case is which brand to buy given that her most preferred brand is located at a distance d from brand x and a distance $1 - d$ from brand y. That consumer will buy the brand that gives her the most consumer surplus, provided of course that her surplus from buying is positive. In other words, this consumer will buy brand x if such a purchase yields a positive surplus,

$$V - td - p_x \geq 0 \tag{21.3}$$

and if that surplus is greater than the surplus earned from buying the alternative good, y,

$$V - td - p_x > V - t(1 - d) - p_y. \tag{21.4}$$

Let us suppose that V is sufficiently large or the prices of the brands, p_x and p_y, are sufficiently low so that all consumers find it worthwhile to buy one of the two brands and that both brands have positive market share at these prices. This means that there must be a consumer, whose preferred brand is located at some distance $\bar{d}$ from brand x, and who is indifferent between buying brand x at price p_x and buying brand y at price p_y. For a consumer to be indifferent to the two brands, the consumer gets the same consumer surplus from buying one or the other, or:

$$V - t\bar{d} - p_x = V - t(1 - \bar{d}) - p_y. \tag{21.5}$$

The location of the marginal consumer, $\bar{d}$, the one who is indifferent between buying x and buying y, is affected by the prices that the two firms set for their brands. Specifically, we can solve equation (21.5) in terms of $\bar{d}$. Thus,

$$\bar{d} = \frac{1}{2t}(p_y + t - p_x) \tag{21.6}$$

If the price p_x of brand x increases, then the location of consumer $\bar{d}$ moves to the left and the fraction of consumers who buy x falls. In contrast, if the price p_x decreases, then the location of consumer $\bar{d}$ moves to the right and the faction of consumers who buy x rises. In other words, $\bar{d}$ and $(1 - \bar{d})$ are the market shares of brands x and y, respectively. Recall that N is the total number of consumers evenly distributed from one end of the line to the other. Therefore, at any set of prices, p_x and p_y, consumer demand for brand x can be written as

$$q_x(p_x, p_y) = \bar{d}N = \frac{(p_y + t - p_x)}{2t}N \tag{21.7}$$

Similarly, the demand for brand y is

$$q_y(p_x, p_y) = (1 - \bar{d})N = \frac{(p_x + t - p_y)}{2t}N \tag{21.8}$$

Accordingly the profit from selling brand x is $\pi^x(p_x, p_y) = (p_x - c)(p_y - p_x + t)N/2t$, while the profit from selling brand y is $\pi^y(p_x, p_y) = (p_y - c)(p_x - p_y + t)N/2t$. We can now derive

each firm's profit-maximizing best response function in prices and work out the Nash equilibrium in prices when consumers are perfectly informed about brands. The best response function for brand x is $p_x^* = p_y + c + t/2$, and the best response function for brand y is $p_y^* = (p_x + c + t)/2$.[1]

Our assumption that each firm has an identical unit cost of c implies that in a symmetric equilibrium each firm also has the same profit-maximizing price. This leads to equilibrium prices in the benchmark case that include a markup over cost equal to the measure of how specialized are consumer tastes, as represented by the parameter t. Hence, the equilibrium prices in the benchmark case are:

$$p_x^* = p_y^* = c + t \tag{21.9}$$

Practice Problem 21.1

Consider two firms producing differentiated products and serving a market of 1,000 customers. Each firm has a unit cost, c, of \$5. Assume as well that the degree of specialization in consumer tastes is t = \$4.

a. What will be the equilibrium price of each firm according to equation (21.9)?
b. What market share will each firm have at these prices? What profit will they each earn?
c. Suppose that one firm lowered its price by \$1 below the equilibrium derived in part (a). What would happen to this firm's market share? What would happen to its profit?

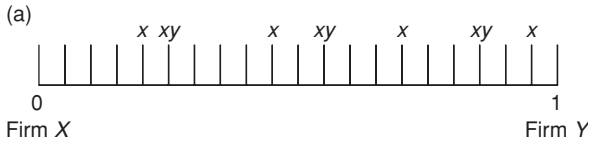
It is worth emphasizing that the equilibrium prices in equation (21.9) and the underlying demand functions upon which they are based depend strongly on the assumption that all consumers in the market are perfectly informed about the availability of the two brands. In the absence of an airtight means to distribute that information to each and every potential customer, it is more likely that consumers are not well informed about the brands. Obviously, advertising can play an informational role here. Yet it is far from a foolproof technique to "get the word out" about one's product. Some consumers may remain uninformed about how many brands are on the market and the specific features of each brand even after an extensive advertising campaign.

In order to introduce advertising in the context of this model, we adopt an approach based on Grossman and Shapiro (1984).[2] In this model a consumer knows the important information about a brand (i.e., its location and price) only when the consumer receives an advertisement from the firm selling that brand. In addition, the probability that each consumer actually receives that message is less than one. This is not unreasonable. When a firm airs a commercial, it is quite likely that some consumers will not hear it, and so not every one is informed in this market.

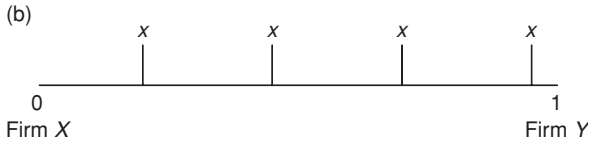
Formally, we assume that consumers located along the segment have the same chance of receiving an advertisement about a brand. In particular, we assume that a proportion, θ_x, of

[1] The best response function for firm 1 is found by maximizing firm 1's profit with respect to its price p_1 given p_2.

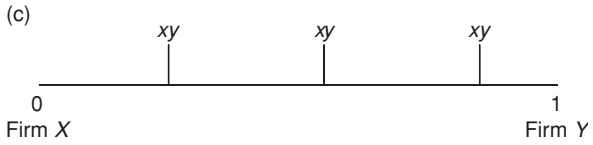
[2] Our model is similar to that developed in Tirole (1988) as a simplification of the Grossman and Shapiro model (1984).



N customers are evenly distributed between the two firms. Those marked *x* have heard commercials about brand *x*. Those marked *xy* have heard commercials about both brand *x* and brand *y*.



Those consumers who have heard only about brand *x* are also distributed uniformlybut less densely than the full market of *N* consumers between firm *X* and firm *Y*. These consumers are assumed to buy one unit each of brand *x*.



The consumers who have received commercials from both brand *x* and brand *y* are distributed uniformly between firm *X* and firm *Y* as well but, again, less densely than the full market of *N* consumers. The two firms therefore must compete for these consumers in price. Given the uniform distribution of this group, we may the same marginal consumer condition used earlier in the case with *N* fully informed consumers. Because there is no price discrimination, it is the set of prices established by this competition that is paid by every consumer both those who know of both brands and those who know of only one brand.

Figure 21.1 Advertising in a Hotelling spatial model

the total population of N consumers receives an advertisement about brand x.[3] Similarly, we assume that a proportion, θ_y, of all potential consumers receives an advertisement about brand y. The fraction θ_x that receives an advertisement for brand x may be further divided into two groups. One group is the proportion $\theta_x\theta_y$ who also received an advertisement for brand y, and the remaining group is the fraction $\theta_x(1 - \theta_y)$ who received the message from firm X but did not hear a commercial for brand y. There is also a fraction of consumers, $(1 - \theta_x)(1 - \theta_y)$, who receive no advertisement from either firm. We will assume that this last group of consumers simply does not participate in the market—that is, consumers who receive no commercial from either firm do not buy either brand x or brand y.

The situation is illustrated in Figure 21.1. Here, the top part of the figure shows the two firms and the distribution of the N potential customers along the line segment or "Main Street" between the addresses of 0 and 1. Of course, if each of these customers were perfectly informed this entire set of N customers would end up buying either brand x or brand y. However, the

[3] This means that firms do not target their advertising to those most likely to buy their product. Firm *X*, for example, is assumed not to concentrate its advertising on the eastern side of town near its own location but, instead, to advertise over the entire market evenly. Television commercials that are aired to all viewers probably come close to this description, though even here we often observe some targeting, e.g., advertising for kids' cereals and toys is heaviest on Saturday mornings during the "cartoon hours."

illustration shows that in fact not all of these individuals are truly potential customers for each firm. From the viewpoint of firm X for instance, only two subsets of the original N customers may actually purchase the firm's product. The first group is comprised of that fraction of customers, $\theta_x(1 - \theta_y)N$, who heard only the commercial of firm X. These consumers are expected to be distributed uniformly between the two ends of the town, but less densely than the full population of N consumers. Whereas there is a customer at every vertical mark along the line segment between 0 and 1, those that are also marked with an x are the consumers who received ads only about brand x. If we draw a picture of this set of customers by themselves, it will look exactly like the picture of the original N customers except that there will be fewer people living less densely between the two town ends. This is what is shown in the middle illustration of Figure 21.1. We will assume that each of these consumers buys a unit of firm X's product; that is, firm X does not have to compete for their business but, instead, captures all these consumers for itself.

The other set of potential customers for the brand x version of the good are those who have heard the commercials of both firms. These consumers are also distributed between the addresses of 0 and 1, and are each indicated with an xy in the top illustration of Figure 21.1. A picture of this group—who are $\theta_x\theta_y N$ in number—is shown in the bottom illustration of the figure. Once again, this subset of customers is expected to be distributed uniformly along the line between the two ends of town. But again, they are distributed less densely than the total set of N consumers.

There is an important difference between this last group of consumers and those in the subset illustrated in the middle diagram of Figure 21.1. Unlike that former group who we assumed will buy only brand x, this latter group that has received both firms' commercials will potentially buy the product of either firm depending on which deal is more attractive. In other words, these $\theta_x\theta_y N$ consumers are perfectly informed just as in our earlier benchmark case. Hence, the two firms will compete in price for this subset of $\theta_x\theta_y N$ customers in exactly the same way as they competed for the full range of N customers in that previous case. This means that we can once again talk about a critical consumer with an address of $\bar{d} = (p_y + t - p_x)/2t$. The only difference is that this consumer now defines the dividing line between the two parts of the smaller market comprised only of the $\theta_x\theta_y N$ customers who have received the advertisements of both firms rather than the entire market of N consumers as in the perfect-information case.

The foregoing analysis implies that the demand for brand x is comprised of two parts. The first part is the $\theta_x(1 - \theta_y)N$ consumers who have heard only firm X's commercial and who we assume buy firm X's product. The second part comes from the $\theta_x\theta_y N$ consumers who have heard commercials for both products and for whose patronage the two firms must compete through the prices they set. What this tells us is that the demand for brand x, denoted by q_x, depends on the advertising efforts of each firm, θ_x and θ_y, and the prices each charge, p_x and p_y, as given by the equation:

$$q_x(\theta_x, \theta_y, p_x, p_y) = \theta_x(1 - \theta_y)N + \theta_x\theta_y\bar{d}N = \left(\theta_x(1 - \theta_y) + \theta_x\theta_y\frac{(p_y + t - p_x)}{2t}\right)N \quad (21.10)$$

where, as before, $\bar{d} = \dfrac{1}{2t}(p_y + t - p_x)$.

Equation (21.10) makes quite clear that firm X has an incentive to raise θ_x and to increase consumer demand for brand x. However, to increase θ_x or the likelihood that consumers will

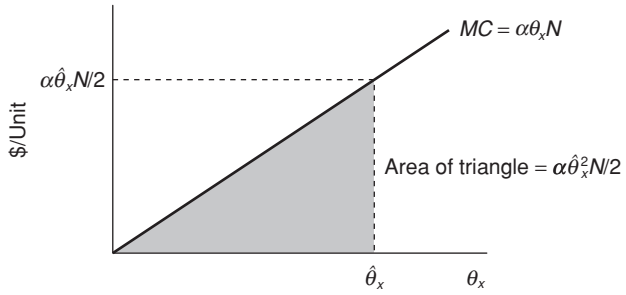


Figure 21.2 Marginal and total advertising cost assumed for the spatial competition model
The marginal cost is indicated by the upward-sloping line and is equal to $\alpha\theta_x N$. The upward slope indicates that the marginal cost rises as the firm tries to reach a greater fraction θ_x with its advertising. The total cost of reaching any specific fraction θ_x is given by the area of the triangle below the marginal cost line up to that fraction. Total cost of reaching θ_x of the N consumers is $\alpha\theta_x^2 N/2$.

know about brand x also requires that firm X increase its advertising expenditures. To put it differently, the expenses associated with airing advertisements for brand x will be larger as the fraction of consumers θ_x that the firm decides it wants to reach becomes greater.

We can write this formally by saying that a firm's advertising costs $T(\theta_x)N$ are a function of the total number of consumers that the firm tries to inform. It is reasonable to assume that this function is increasing in θ_x. As the firm tries to contact a greater fraction θ_x of consumers, its advertising expenses increase. Moreover, we will assume that this happens at an increasing rate. Thus, we will assume that advertising is subject to diminishing returns.

One way to obtain this feature is to assume that the additional cost incurred in raising θ_x—that is, the marginal cost of raising the fraction of consumers that hear about brand x, or what we will denote as T'—is given by the equation $T' = \alpha\theta_x N$. Such a function is illustrated in Figure 21.2. It is of course a simple linear relationship beginning at the origin and rising with slope α. The total cost of advertising for any given value of θ_x such as $\hat{\theta}_x$, is $T(\hat{\theta}_x)N$ and is just the sum of the marginal cost of each increment in θ_x up to the value $\hat{\theta}_x$. This is just the area of the triangle under the curve, which is equal to $\frac{\alpha}{2}\hat{\theta}_x^2 N$. Hence, our assumption that $T' = \alpha\theta_x N$ is equivalent to assuming that $T(\theta_x)N = \frac{\alpha}{2}\theta_x^2 N$. In other words, we are assuming that advertising costs rise with the square of the fraction of the market that the firm attempts to inform.[4]

Given its demand curve, firm X wants to choose a price, p_x, and an advertising strategy, θ_x, to maximize the profit from selling brand X. This profit is equal to the firm's revenue less its costs. Its revenue is equal to the price it sets times the amount demanded at that price. Its cost is the sum of its production cost—the unit cost, c, times the amount it sells—and its advertising cost, $T(\theta_x)N$. Formally, the firm wants to maximize its profit, θ_x:

$$\Pi_x(\theta_x, \theta_y, p_x, p_y) = (p_x - c_x)\,[\theta_x(1 - \theta_y)N + \theta_x\theta_y\bar{d}N] - \frac{1}{2}\alpha\theta_x^2 N \tag{21.11}$$

[4] Recall that the area of a triangle is given by $bh/2$, where b is the length of the triangle's base and h is the triangle's height. In Figure 21.2, the base or b is θ_X, and the height is $\alpha\theta_X N$. Hence, the area of the triangle, or total cost of reaching the fraction θ_X of all N consumers, is $\alpha\theta_x^2 N/2$.

Maximization of this profit function requires that the firm's price and advertising choices jointly satisfy two profit-maximizing conditions. The first of these conditions is the familiar one that, given its advertising level, as well as the price and advertising level of its rival, the firm set its price to equate marginal revenue with marginal production cost. This condition can be solved to find the best response function in price for firm *X*:

$$p_x^* = \frac{p_y + t + c}{2} + \frac{(1 - \theta_y)}{\theta_y} t \tag{21.12}$$

Equation (21.12) is firm *X*'s best price response function given the price and advertising effort of firm *Y*. Note that it is made up of two terms. The first term is in fact the best price response function for firm *X* when all consumers are perfectly informed about both brands as in our benchmark case.[5] The second term describes the additional markup when consumers do not know about the competing brand *y*. The smaller the fraction of consumers who receive advertising about brand *y*, the higher is the profit-maximizing price for brand *x*.

The second necessary condition is also one that is familiar. This is the requirement that the marginal benefit of reaching additional consumers through increased advertising just equal the marginal cost of such advertising given the firm's price level and the actions of its rival. The marginal benefit of additional advertising is the increased number of customers it brings in times the price-cost margin that the firm earns on each of these additional sales. Since we have assumed that the marginal cost of such additional advertising message is $\alpha\theta_x N$, this condition can be written as:

$$(p_x - c)\left[(1 - \theta_y) + \theta_y\left(\frac{p_y - p_x + t}{2t}\right)\right]N = \alpha\theta_x^* N \tag{21.13}$$

Similarly, we work out the corresponding profit-maximizing conditions for firm *Y*. To find the equilibrium outcome we can take a short cut. The firms are identical with respect to both costs and demand. Thus, we know that in equilibrium both $p_x^* = p_y^*$ and $\theta_x^* = \theta_y^*$ will hold. When we substitute these two equilibrium relationships into the two conditions (21.12) and (21.13), we obtain the equilibrium price p^* and advertising level θ^*, for each firm (see inset). These are

$$p^* = c + \sqrt{2\alpha t} \tag{21.14}$$

and

$$\theta^* = \frac{2}{1 + \sqrt{\frac{2\alpha}{t}}} \tag{21.15}$$

[5] You can easily confirm this. Since the two firms are identical, the equilibrium must involve $p_x^* = p_y^*$. When the second term in equation (21.9) is omitted, imposing this condition then yields our initial, fully informed equilibrium, $p_x^* = p_y^* = c + t$.

Derivation Checkpoint

Optimal Advertising and Optimal Pricing in the Spatial Model

In the two-firm Hotelling model with advertising, we must now recognize that firms are optimizing on two fronts. They must choose both a profit-maximizing price and a profit = maximizing advertising effort. In turn, this requires that we differentiate the profit function of equation (21.1) with respect to both p_x and θ_X, and set each derivative equal to zero. The two resulting first-order equations may then be expressed as:

$$\left[\theta_x(1-\theta_y)+\theta_x\theta_y\left(\frac{p_y+t-p_x}{2t}\right)\right]=(p_x-c)\left[\frac{\theta_x\theta_y}{2t}\right] \quad \text{and}$$

$$(p_x-c)\left[(1-\theta_y)+\theta_Y\left(\frac{p_y+t-p_x}{2t}\right)\right]=\alpha\theta_x$$

Of course, similar necessary conditions also apply to firm Y. Multiplying through the first of the above equations by $2t$ and simplifying then yields firm X's best price response function shown in equation (21.12) and below:

$$p_x=\frac{p_y+t+c}{2}+\left(\frac{1-\theta_y}{\theta_y}\right)t$$

If we now invoke the symmetry requirement that, in equilibrium, $p_x = p_y = p^*$ and $\theta_x = \theta_y = \theta^*$, this condition may be rewritten to imply that in equilibrium:

$$p^*=t+c+2\left(\frac{1-\theta^*}{\theta^*}\right)t \quad \Rightarrow \quad (p^*-c)=\left(\frac{2-\theta}{\theta}\right)t$$

From the second first-order condition, substitution also yields:

$$(p^*-c)\left(1-\frac{\theta^*}{2}\right)=\alpha\theta^*$$

Substitution of the implied value for $p^* - c$ from the first condition into the second one then yields the equilibrium advertising effort shown in equation (21.15) and below:

$$\left(\frac{2-\theta^*}{\theta^*}\right)t\left(1-\frac{\theta^*}{2}\right)=\alpha\theta^* \quad \Rightarrow \quad (2-\theta^*)^2t=2\alpha\theta^{*2} \quad \Rightarrow \quad \theta^*=\frac{2}{1+\sqrt{\frac{2\alpha}{t}}}$$

Substitution of the solution for θ^* into the equilibrium pricing relationship then yields:

$$p^*=c+\sqrt{2\alpha t}$$

Remember that we assumed that some of the initial N consumers in the market remain uninformed.[6] In order for this to be the case, there must be some consumers who do not receive an ad from either firm. Therefore, it must be the case that the equilibrium value of each firm's advertising effort θ^* is less than one. To guarantee that $\theta^* < 1$ we assume that the cost of advertising, as measured by the parameter α, is not too low relative to consumers' preference for variety, as measured by t. Specifically we want $\alpha > t/2$ so that it is too costly for a firm to find it profitable to inform the entire consumer population about its brand.[7] When $\theta^* < 1$ we have in equilibrium a fraction $2\theta^*(1 - \theta^*)$ of consumers who know only about one brand, a fraction θ^{*2} who know about both brands, and a fraction $(1 - \theta^*)^2$ who do not know about either brand.

To make the foregoing a bit more concrete, consider a simple example in which there are $N = 1{,}000$ consumers, each with a reservation price of $V = 10$ and a taste parameter $t = 2$. The unit cost of production is $c = 2$, and the cost of advertising is such that $\alpha = 4$. The perfect information equilibrium or benchmark case for this example is one in which the two firms split the market with each charging a price of $c + t = 4$ by equation (21.9). How does this compare with the imperfectly informed equilibrium with advertising?

From equation (21.14), the price in the imperfectly informed equilibrium will be $p^* = 6$. From equation (21.15) the advertising effort by each firm will be $\theta^* = 2/3 = 0.67$. Note that the equilibrium price has increased from \$4 to \$6, or by a factor of 50 percent over its value in the fully informed benchmark case. Given the advertising efforts of the two firms, 22 percent $[\theta^*(1 - \theta^*)]$, or 222 of the 1,000 consumers, know about brand x only. Similarly, another 22 percent know only about brand y. In addition, 44 percent $(\theta^*\theta^*)$, or 444, know about both brands. The remaining 12 percent $[(1 - \theta^*)(1 - \theta^*)]$ do not know about either brand.

These data imply that each firm sells 444 units. Each sells 222 units to the consumers that know only its brand. In addition, the two firms split the market of 444 consumers who know about both brands. At a price of \$6, each firm therefore earns revenue of \$2,664. At a unit cost of \$2, the total production cost at each firm is \$888. In addition, each firm incurs a total advertising cost of $4000(2/3)^2/2 = \$888$. Total cost—production plus advertising cost—is therefore, \$1,776. Subtracted from each firm's total revenue, this leaves each firm with a net profit of \$888. Note that on a per unit basis, each firm incurs an advertising cost of \$2, which in this case is just as high as its per unit production cost. However, such advertising costs are necessary in this market for a firm to get its product known.

The market outcome that we have just derived yields a number of insights regarding advertising in product-differentiated markets where firms compete for consumers in price. First, note that our assumption that $\alpha > t/2$ implies that the equilibrium price will now be greater than $c + t$—the price that prevailed under the fully informed equilibrium, (see equation (21.9). The higher price is necessary, in part, to fund the advertising that provides consumers with the information that they need in order to go shopping.

[6] Indeed, it is this assumption—made rather implicitly—that explains why the equilibrium price shown in equation (21.11) does not converge to the equilibrium when one lets α take on the value $t/2$ necessary to make α equal 1. Having derived the equilibrium under the assumption that $\theta < 1$ and the market is imperfectly informed, we cannot now impose on that equilibrium result the contrary assumption that $\theta = 1$ and the market is perfectly informed.

[7] However, we do not want the cost of advertising to be so high that firms send out so few ads that there are too few consumers who know about both brands. In such circumstances firms find it not worthwhile to compete in price to attract these consumers.

The foregoing is not to say that the higher price only covers the cost of the advertising that takes place. That higher price also reflects the advantage that each firm now has with respect to an important fraction of its customers. This advantage is that some of those customers do not know about the rival brand. As a result, those consumers are willing to pay any price for, say, brand x that yields a positive surplus. Had they known about the existence of brand y, however, they would only be willing to pay a price for brand x that yielded no less a surplus than that obtained from buying the alternative brand. A real-life example may be consumers who purchase a high-priced national brand of pain relief because they are unaware that a generic substitute is available.

A further insight from our analysis is that an increase in the degree of specialization in consumer tastes—an increase in t—causes both price and advertising to increase. Prices are higher and advertising expenses are larger the more that differences in product brands do in fact matter to consumers. Here is yet another case in which it is important to understand that advertising does not play a causal role in these results. Advertising is not the force that causes consumers to have specialized tastes nor is it the factor that enables firms to set high prices. Instead, it is the fact that consumers have specialized tastes to begin with that both encourages firms to advertise extensively and that permits price to be set well above costs.

The final insight is the relationship implied between profitability and the cost of advertising. Substituting our results from equations (21.14) and (21.15) for the optimal price and advertising efforts into the profit function of equation (21.11), we find that, in equilibrium, each firm will earn a profit, π^*, equal to

$$\Pi^* = \frac{2}{\left(1 + \sqrt{2\alpha/t}\right)^2} N \tag{21.16}$$

Inspection of equation (21.16) reveals that each firm's profit is increasing in the parameter α, which is a measure of the cost of advertising. How is it the case that making it more difficult for firms to inform consumers about their brands results in increased firm profitability? The reasoning is as follows: When α increases, it becomes more costly to advertise to consumers, and so firms reduce their advertising levels. As a result, consumers in the market are now less well informed about the alternatives that are available and so each firm can raise the price of its brand with less fear of losing customer to its rival. The increase in the price–cost margin outweighs the increase in the overall cost of advertising.

There is a well documented "stylized fact" that in a wide cross section of consumer good industries higher advertising expenditures are associated with higher profitability. The pioneering work in this regard is that of Comanor and Wilson (1967). Their basic finding is that industries with high profitability are associated with high advertising to sales ratios, and the relationship between advertising and profitability has been found again and again both for different time periods and different countries. This model is consistent with the empirical evidence. As α increases both industry profitability and advertising expenditures increase.

Another insight is that public policy that attempts to restrict advertising efforts and thereby make it more costly to reach a given number of potential consumers could actually raise the profit of the industry's firms. Perhaps this helps to explain the recent agreement of the major American tobacco companies to abide by a proposed settlement of that restricts advertising of tobacco products. A similar outcome could occur if regulations are enacted to restrict advertising in the alcoholic beverage industry.

21.2 Practice Problem

We have already mentioned the increasing use of the Internet by firms as a medium in which to advertise their products by buying "space" on a firm's home page. Suppose we now project these developments a bit into the future and consider an economy linked by an information superhighway in which the worldwide web allows advertisers to reach hundreds of millions of potential customers. Within the model just developed, such an outcome would be reflected by a sharp fall in the parameter α. That is, because the web has no distribution or printing fees and because it reaches so many customers, the cost of reaching any potential consumer is sharply reduced.

a. According to the spatial competition model just developed, what effect will a sharp fall in α have on the fraction of potential consumers who hear a firm's message?
b. What does the model imply will be the impact of this sharp fall in α on the firm's price-cost margin, $p - c$? What effect will it have on firm profits? Explain.

21.3 WHAT'S IN A BRAND NAME?

Brand names like Fruit-Loops or Cheerios correspond to different kinds of cereals, and consumers seem to care about variety in the cereal market and making the right match. Often there is more to a brand name. Brand names like Coca-Cola in the soft drinks market, or Calvin Klein in the jeans market have a social or psychological edge that goes beyond our simple interpretation of matching or mapping consumers to brands. Consumers may prefer Coke to Pepsi not because of the taste but because of the brand name. Consumers may prefer to buy Calvin Klein jeans not because of the fit but because of the name. Recognizing that there is a "peer pressure" quality in brand names and their advertising points us back to the view of advertising as a persuasive message. However, such messages do not have to change consumer tastes in order to have an impact on consumer utility.

This subtle point is made clear in Becker and Murphy (1993). These authors take a different view of the persuasive role of advertising. They argue that yes, these image ads do stimulate wants but, no, such advertisements do not necessarily change consumer preferences. The reason why image advertising can affect the demand for goods *without necessarily changing the underlying preferences* of consumers is that this kind of advertising may be a complementary good to the product. In the same way that consumers place a greater value on lodging accommodations the better the surrounding landscape, or on iPods, the greater the availability of iTunes, they may also place greater value on a soft drink or an automobile or a pair of jeans the greater the advertising done by the soft drinks maker or auto maker or clothing firm, respectively.

There are several ways in which advertising can be thought of as a complement to the good being promoted. One is that some consumers may enjoy knowing that the brands of products that they buy are widely seen and recognized by lots of others on television, in the movies and on billboards. Advertising in this case enhances the consumption value of the product by making it more prestigious and desirable because that is how it is seen in the eyes of the consumer's friends and acquaintances.[8] This view of advertising is close in spirit

[8] Clark and Horstmann (2005) show that if consumers care about wearing the "right" clothes or eating the "right" food then firms can use advertising to coordinate consumer purchases. Consumers believe that a firm advertising more will have more purchases and a more valued product. This builds on the Bagwell and Ramey (1994) idea that advertising is a coordinating mechanism.

to the traditional persuasive view. The subtle difference here is that consumers are not duped into believing that advertised goods are better. Rather the extensive advertising actually serves to make those goods better known and hence worth more to consumers who enjoy using brands that are widely known. This kind of advertising campaign is aimed at building brand value. Its goal is to make the product more desirable and to increase the willingness to pay of consumers.

At the same time, it seems clear that brand name advertising can also convey information, such as how to use the good or service more effectively. For example, the food-manufacturing giant, General Mills, operates a website for its brand name Betty Crocker. Among other offerings, this site includes a link to "Betty's Recipes—What's on Hand?" Here, the interested browser is asked to list the ingredients that are available for that night's meal. Then, the site provides a number of "Betty's Favorite Recipes" which utilize those very ingredients. The recipes include both preparation steps and nutritional information. However, when listing the ingredients necessary for each dish, the site always gives a plug for the General Mills brand of that product, e.g., Gold Medal all-purpose flour.

Clearly, this kind of advertising does play an informative role. Yet the information provided is not about the product's price, quality, or retail store location. Instead, the information is of the sort that will enable the consumer to use the advertised product more effectively and, thereby, to obtain greater benefits from it. This kind of campaign extends the reach of the brand and can expand the market by bringing in new consumers. Alternatively, consumers would be willing to pay for this kind of information—a cookbook, a software user's guide, a car owner's manual—if such information were not readily available. More often, however, the information is sold bundled with the good at one price. Brand name advertising that serves a similar "how to" role may be viewed similarly. The consumer buying the product pays for both the product and the information included in the advertising. This is not so very different from the consumer who buys a software package at a price, which also includes a software user's guide.

Whether advertising provides social appeal or complementary information or a combination of both, the result is that consumers value the joint consumption of the product and its advertising. This approach to advertising is different from the approach that lies at the heart of the signaling theory discussed in the last chapter. Signaling theory is based on the premise that advertising does not itself give utility to consumers but rather is a signal for what does give them utility. The view that advertising is a complement to the good advertised is, on the other hand, based on the premise that advertising itself is desired by consumers.

An important advantage of the complementary approach to advertising is that it is consistent with the fact that consumers who have already tried an experience good and know its quality continue to respond to advertising, and with why there is considerable advertising for goods that do not fit the experience good category. Viewing advertising as a way to make the product better known can also account for the observation—unexplained by the signaling approach—that advertising is much greater for experience goods sold to consumers than those sold to producers.

When advertising is viewed as a complement to the good being marketed firms can raise the demand for their good by increasing their advertising. Corresponding to our description above, we consider two ways that advertising, when viewed as a complementary good, can affect consumer demand. One way is by increasing the social value of brand name appeal that is closer in spirit to the persuasive role of advertising. The second way is by conveying information on how to better use the product that is closer to the more purely informational role of advertising. We first explore the complementary approach to advertising in the context of a monopoly. We then briefly outline its application in a competitive setting.

21.3.1 Advertising and Building Brand Value

Consider a firm that sells a product such as a car, or a new book, or a film video, or a spring coat, of which each consumer typically wishes to buy only one unit. There are N potential consumers of the product. Assume further that each consumer differs by how much utility he or she gets from consuming the product. Specifically, we assume that consumers can be ranked in terms of the utility each gets from consuming the good. Consumer utility ranges from a minimum value of 0 to a maximum value denoted by $\bar{V}$.[9] In the absence of advertising, the consumer least interested in the product receives a utility from consuming the product equal to 0. Such a consumer will not purchase the product unless it is given away for free. The next person obtains a utility equal to $\bar{V}/N$; the third least interested consumer obtains a utility equal to $2\bar{V}/N$; and so on all the way up to the most interested consumer who obtains a utility equal to $N\bar{V}/N = \bar{V}$ from consuming the product. We may thus think of each consumer as located along a line segment with the addresses on that line ranging from 1 to $N + 1$. If we refer to consumers by their addresses, consumer n will, in the absence of advertising, obtain a utility equal to $(n - 1)\bar{V}/N$ if she consumes the product, where n ranges from 1 to $N + 1$.[10]

Advertising enhances consumer utility from consuming the product. To be explicit, we assume that effect of advertising is to increase consumer's utility multiplicatively by a factor, $v(\alpha)$, where α is the level of advertising services provided by the monopoly firm. Hence, the utility enjoyed by consumer n when she consumes the good with advertising α is now $v(\alpha)(n - 1)\bar{V}/N$. We assume that $v(0) = 1$, so that if the good is not advertised at all ($\alpha = 0$) then each consumer n merely obtains their base utility from consumption of the good. When the good is advertised and α is positive, then $v(\alpha)$ is greater than one and each consumer's utility from consumption is increased. Moreover, the scale factor $v(\alpha)$ increases as α does, or $v'(\alpha) > 0$.

Because advertising increases the overall utility derived from the consumption of the good, each consumer is willing to pay *more* for the good the *more* it is advertised. A consumer will buy the product whenever her utility level exceeds the product price; in other words, when consumer surplus is positive. Therefore, a consumer n will buy the product whenever:

$$v(\alpha)\left(\frac{n-1}{N}\right)\bar{V} - P \geq 0.$$

We can now derive the demand curve facing the monopoly firm. Suppose that the firm decides to advertise an amount α and to sell the good at price P. How much of the good will the firm sell? To answer this question, assume that over the population of consumers, that is, over the range of addresses n that run from 1 to $N + 1$, there is, at these values of α and P, some consumer with address $\hat{n}$ who is just indifferent between buying and not buying. This consumer is called the marginal consumer. For this consumer $\hat{n}$ it will be the case that $v(\alpha)\left(\frac{\hat{n}-1}{N}\right)\bar{V} = P$. All consumers with lower addresses or lower values of n will not buy the product. They do not value it highly enough. All the consumers with higher

[9] For example, if the good were a new cosmetic treatment and if utility were measured in dollars $\bar{V}$ could be equal to \$100, or for a new holiday package $\bar{V}$ could be \$1,000.

[10] We permit n to range as high as $N + 1$ in the numerator because we start at 0 as the lowest valuation of the product. In order to have N customers with N separate utilities, the first being 0, the addresses must range from $n = 1$ to $N + 1$.

addresses or higher values of n will buy the product. If we use the equality above to solve for the address of the marginal consumer, $\hat{n}$, we find that:

$$\hat{n} = \frac{NP}{v(\alpha)\bar{V}} + 1 \tag{21.17}$$

Recall that the minimum value of $\hat{n}$ is 1 and the maximum value is $N + 1$. When price P is near 0, or at very high levels of either $v(\alpha)$ or $\bar{V}$, all N consumers will wish to buy the good. At high levels of P or low levels of either $v(\alpha)$ or $\bar{V}$, no consumers will wish to buy the good. Hence, total demand when the firm advertises at level α and charges price P is the fraction of the N potential consumers whose address or n value exceeds $\hat{n}$. This is given by:

$$Q^D(P, \alpha) = \left[\frac{N + 1 - \hat{n}}{N}\right]N = \left[\frac{N - \dfrac{NP}{v(\alpha)\bar{V}}}{N}\right]N = \left[1 - \frac{P}{v(\alpha)\bar{V}}\right]N \tag{21.18}$$

The total demand for the firm's product is negatively related to the price it charges, P, but positively related to the extent of advertising, α. Note that the demand function is linear in price, and can be represented in what follows more simply by the form: $Q^D(P, \alpha) = a - \dfrac{b}{v(\alpha)}P$. As advertising or α increases, so does the factor $v(\alpha)$ and, hence, the demand curve rotates outward as shown in Figure 21.3.

When the amount of advertising is increased the demand function shifts out and so does consumer willingness to pay. Moreover the willingness to pay of those consumers who really like the good, that is, the relatively high V consumers, increases proportionately more. These consumers are called the inframarginal consumers. The rotation pictured in Figure 21.3 implies that when advertising is increased the inframarginal consumer's willingness to pay for the good goes up by proportionately more than does the marginal consumer's willingness to pay.

When brand names have a recognition or prestige value then consumers actually enjoy watching or reading advertisements. In this case, they should have an incentive to listen to

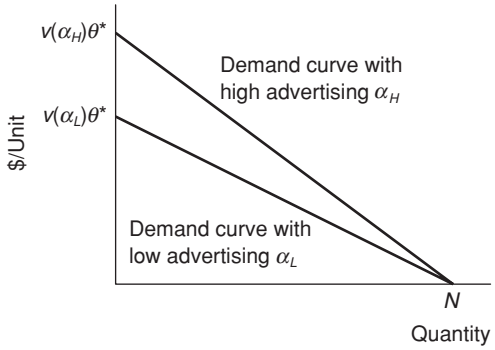


Figure 21.3 Effect of advertising services α on firm's demand when advertising raises brand value

all the advertising sent out by the firm.[11] However, this is less likely to be the case when advertising is purely informative. We all know individuals who, as soon as there is a commercial break in a television program, jump up to do something else. Not everyone consumes or cares about the advertising that a firm sends out. This means that there is a "hit or miss" problem of reaching consumers with advertising and this feature is not captured well in the above approach to brand names and advertising.

Suppose instead that unless a firm's potential customers hear or see a commercial message then they may not know that the product is available or alternatively they will not know how to use the product. The problem is that some consumers may not pay attention to the message when it is aired. Cellular phones are a case in point. It seems clear that many consumers are simply unaware of the easy availability of such technology or, perhaps, how to get any real use out of such devices. While this is bad enough for the uninformed consumer, it is especially disappointing to the firm who can only sell its products to consumers who know those products are there and who also understand how to work them. We now turn to an alternative view of advertising and building a brand name that captures this informational aspect of the firm's marketing problem.

21.3.2 Advertising and Extending the Reach

Suppose that if a firm did not advertise and build a brand name for its product then consumers would simply not know about the product, or know that they had a demand for it. This scenario could be appropriate to the marketing of cellular phones or a brand new pharmaceutical product. The essential point is that, in the absence of information about how best to use the product, consumers may not demand any of the good at all. The informational content of advertising is, in this case, complementary to the advertised product in so far as without it, the consumer will simply refrain from buying the product altogether. We will also suppose that when a firm sends out ads, not every potential customer will actually receive the ad. Some will miss it altogether. Others may see it but not really pay attention to its content. Consequently, advertising messages are received randomly by consumers. The issue that we want to explore is how advertising for brand recognition creates effective demand for the firm's product in this setting.[12]

Once again denote the number of potential consumers interested in buying this new product as N, which we assume to be a very large number. Furthermore, we suppose that all consumers are identical. Specifically let each consumer, once fully informed about the product, have a demand that is described by the function $q(P)$, which we assume is decreasing in price P. If all N consumers were in fact perfectly informed about the product, the monopolist's demand curve would be $Q(P) = Nq(P)$.

All consumers may not, however, be informed. To become informed, a consumer must receive, i.e., see and understand an advertisement. Some consumers may not truly hear the advertisement's message either because it never reaches them at all or because, if it does, they mentally "tune it out." We model this "hit or miss" aspect of advertising by assuming that if the monopolist sends out only *one* ad to the group of N potential customers, then each

[11] On this point it is interesting to note that Becker and Murphy (1993) cite a study by several psychologists who did find that people who have recently purchased a new car were more likely to read ads for the same type of car than for other types.

[12] This specification of advertising is based upon the model in Butters (1977).

such consumer has a probability $1/N$ of receiving it. Alternatively, each consumer has a probability of $\left(1 - \frac{1}{N}\right)$ of not receiving the one ad.

However, the monopolist can send out more than just one ad. Suppose that the monopolist sends out two ads. The probability that any one consumer receives *neither* message is then $\left(1 - \frac{1}{N}\right)^2$. By extension, if the monopolist sends out α messages, then the probability that a consumer does *not* receive any one of these α advertisements is $\left(1 - \frac{1}{N}\right)^{\alpha}$. When N is a large number, the probability that any one consumer *does not receive* an ad can be approximated by the function $e^{-\frac{\alpha}{N}}$, where e is the natural logarithm base, 2.7183. That is, the probability $\left(1 - \frac{1}{N}\right)^{\alpha} \approx e^{-\frac{\alpha}{N}}$. Since the probabilities of all possible events must sum to 1, this in turn means that the probability that any one consumer ***does receive*** an ad from the monopolist is $1 - e^{-\frac{\varepsilon}{N}}$.

Therefore, of the N potential consumers, the number of consumers the monopolist can actually expect to hear about the product when α ads are sent out is: $\left(1 - e^{-\frac{\alpha}{N}}\right)N$. Since each of these consumers will, when informed, exhibit a demand for the product equal to $q(P)$, the monopolist's expected demand is:

$$Q^D(P, \alpha) = \left(1 - e^{-\frac{\alpha}{N}}\right)Nq(P). \tag{21.19}$$

Assuming that the individual consumer demand function $q(P)$ is linear in price then the market demand function is also linear in price and can be more simply represented by:

$$Q^D(P, \alpha) = g(\alpha)(a - bP), \text{ where } g(\alpha) = \left(1 - e^{-\frac{\alpha}{N}}\right).$$

As in the previous case, increases in advertising or α will raise the expected demand at a given price. However, in this case the effect is to rotate the demand curve out in the way that we have shown in Figure 21.4. When the monopolist increases the amount of advertising the demand curve for the product again shifts out, but now the willingness to pay of the consumer who is on the margin of buying or not buying increases proportionately more than that of the inframarginal consumer.

21.3.3 Brand Name Advertising and Prices

The two cases just described are examples of the different ways advertising, or a brand name, can serve as a complementary good and thereby affect the demand for the advertised product. In both cases market demand is decreasing and linear in price and increasing in advertising. The way in which increases in advertising affect market demand is, however,

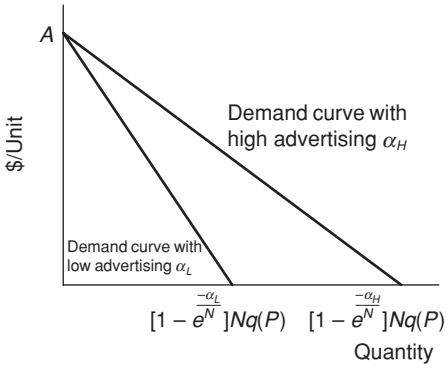


Figure 21.4 Effect of advertising services α on firm's demand when advertising extends reach

different for the two cases. Specifically, for the *building brand value* case the monopolist's demand function is represented by $Q^D(P, \alpha) = a - \frac{b}{v(\alpha)}P$, whereas for the *brand recognition* case the monopolist's demand function is given by $Q^D(P, \alpha) = g(\alpha)(a - bP)$. The fact that increases in advertising will *at a given price* increase demand for the monopolist's product is the "good news" of advertising. The "bad news" is of course that advertising is costly. We will assume that every unit of advertising costs T dollars.[13] We also assume that every unit of output costs c dollars to produce. The task confronting the firm is to pick a level of advertising, α, and a level of production Q, or price P that together maximize profit.

It is interesting to compare the effect of advertising on the firm's pricing strategies in the two cases. Consider first the *brand recognition* case. We find it more convenient to work with the *inverse* demand function, which for the *brand recognition* case, can be written as follows: $P(Q, \alpha) = A - \left[\frac{B}{g(\alpha)}\right]Q$. As illustrated in Figure 21.3, increases in advertising in the *brand recognition* case make the slope of the inverse demand function less negative. The firm wants to identify the profit-maximizing quantity of output and advertising to produce. Let us first work out the profit-maximizing quantity of output to produce at a given level of advertising services, α. With advertising α constant, and hence $g(\alpha)$ constant, the firm's marginal revenue curve is: $MR = A - \left[\frac{2B}{g(\alpha)}\right]Q$. Equating marginal revenue to marginal production cost, c, then yields the optimal quantity, Q^* and the corresponding optimal price, P^*. These are:

$$Q^* = \frac{(A - c)g(\alpha)}{2B} \quad \text{and} \quad P^* = \frac{A + c}{2} \tag{21.20}$$

Note that for the *brand recognition* case increases in advertising α lead to an increase in quantity sold, but not to an increase in price.

[13] This assumption may not always hold. Often there is considerable quantity discounting when air time, network time, or magazine space is purchased by a firm for advertising.

On the other hand for the *building brand value* case we have the demand function $Q^D(P, \alpha) = a - \frac{b}{v(\alpha)}P$, which leads to an inverse demand function: $P(Q, \alpha) = v(\alpha)[A - B]Q$. Again, the firm wants to identify the profit-maximizing quantity of output and advertising to produce. The profit-maximizing quantity of output to produce at a given level of advertising services, α, is found by equating marginal revenue equal to marginal cost. That is: $MR = v(\alpha)[A - 2B]Q = c$ yields the optimal quantity, Q^* and the corresponding optimal price, P^*. In this case these are:

$$Q^* = \frac{Av(\alpha) - c}{2Bv(\alpha)} \quad \text{and} \quad P^* = \frac{Av(\alpha) + c}{2} \tag{21.21}$$

In contrast to the *brand recognition* case increases in advertising α in the *building brand value* case do lead to an increase price. However, if unit cost c is relatively small the effect on quantity sold of an increase in advertising in this case is relatively small. In the extreme when unit cost c is equal to zero then Q^* does not depend on advertising in the *building value* case. The two cases help us understand how advertising can have an ambiguous effect on prices depending in part on what is the value of the brand name to consumers. When the building value role predominates we could expect increased advertising and increased prices, but when the informative role predominates increased advertising should not lead to higher prices.

21.3 Practice Problem

Suppose a firm marketing styling gel faces an inverse demand curve $P(Q, \alpha) = \alpha^{1/2}[1 - Q]$ where Q is number of tubes sold per period, measured in millions, and α is advertising seconds on television per period. Currently the firm is advertising 100 seconds. The cost of advertising is $10,000 per second. For simplicity suppose that the production cost of a tube of gel is constant and set to zero. There are no fixed costs.

a. Calculate the firm's profit-maximizing quantity and price. Work out the firm's profit as well.
b. Now suppose that the firm's marketing manager has struck a deal that if the firm advertises 625 seconds the cost of advertising falls to $5,000 per second. Work out what the firm's profit maximizing strategy and profits if it increases it advertising to 625 seconds.

21.4 TOO MUCH OR TOO LITTLE ADVERTISING: THE QUESTION REVISITED

A frequent complaint about network television in the United States is the abundant frequency of commercials. This feature is often cited as a key factor in the demand for both DVD's, premium cable channels, and TIVO all of which permit television viewing uninterrupted by commercials. Such anecdotes suggest that the market place somehow leads to too much advertising. Of course, we need to be precise. In economics, "too much" or "too little" advertising can only be interpreted as an amount of advertising that is either greater than or less than the efficient amount, where by efficient we mean that amount of advertising that maximizes the sum of consumer and producer surplus.

Because efficiency requires price equal to marginal cost, there does at first sight seem to be some logic to the charge of inefficiently excessive advertising. This is because advertising is available to consumers at a zero price, which is likely less than the marginal cost of advertising. Yet if advertising is considered to be *one* of two goods that consumers wish to consume together, then the relevant price is really the combined price of both the product and the commercial advertising it. If the good itself is sold by a firm with market power then the firm will maximize profit by restricting output and raising price somewhat. This would imply that the combined price of the product and the commercial together may not be below their marginal cost.[14]

It turns out that when advertising is a complement to the good being advertised it is possible to show that either too much or too little advertising could result. In general, because the firm chooses the advertising level to maximize profit, the firm does not consider any additional gain in consumer surplus that results from a change in advertising and so will not be induced to produce the efficient amount of advertising. But whether the firm's choice will be too large or too small is not *a priori* clear. A further examination of Figures 21.3 and 21.4 suggests why this is so. The firm's choice depends on how advertising affects the willingness to pay of the marginal consumers.

Figure 21.4 illustrates the case when the effect of advertising is to raise the marginal consumer's willingness to pay proportionately more than that of inframarginal consumers. Figure 21.3 illustrates the alternative case in which the effect of advertising is proportionately greater for inframarginal rather than marginal consumers. These figures are similar to those described in section 7.5.1 in Chapter 7 when we considered how product quality affects consumer demand. There we showed that the firm's choice of quality could be either too small, when the effect on demand is similar to Figure 21.3, or too large, when the effect on demand looks more like Figure 21.4.

What about the effect of competition and other firms' advertising strategies? There are several points to consider. When firms market a more or less a homogenous product then advertising by any one of them increases overall market demand for the product to the benefit of all firms. In this case, a firm that incurs the cost of advertising would not appropriate the full benefit of its action. There would be a "free-rider" effect as firms that did not advertise would still benefit from the increased demand caused by the one firm's advertising. Consequently, the incentive to advertise by any one firm in the market would be considerably weakened—the more so the greater the number of firms. In turn, this would lead us to predict too little advertising when there are many firms and the industry looks more or less competitive. It is precisely this problem that leads to collaborative advertising efforts such as the dairy industry's "Got Milk" campaign. If any one firm paid for such advertising, that firm would earn very little return. By arranging for many firms to sponsor such commercials jointly, the dairy industry hopes to overcome such free rider difficulties.

When the firms in the market sell differentiated as opposed to identical products matters change. If the advertisement is a complement to only the product of the firm sending out the ad, then the free-rider problem disappears and each firm appropriates the benefit from its advertising. However, because it is hard to "stand out in a crowd" we expect that this case will be more likely to hold in markets with relatively fewer firms. This suggests that we

[14] This result is shown formally in Becker and Murphy (1993, pp. 957–8) for a more general model of advertising as a complementary good. In effect, the market for advertisement is not cleared by price but, instead, rationed by the monopolist. Hence, the true marginal benefit to consumers may be either above or below the "price" for advertising that we actually observe.

should observe a negative relationship between industry advertising expenditure and the number of firms in the industry. The fewer the number of firms, or the more concentrated the industry, the greater should be the industry advertising-to-sales ratio.

John Sutton (1991) has offered additional analysis that further supports the foregoing prediction. His work builds on the stylized fact that the greater the extent of sunk costs in the industry, the higher the equilibrium concentration tends to be.[15] Advertising may be viewed as such a sunk cost. Once the ad campaign is mounted and waged, the associated expenses can never be recovered. Hence, Sutton argues that in industries in which such product differentiation through advertising is possible, advertising expenditures will be high. Such industries will therefore be characterized by both considerable sunk cost and a high degree of concentration.

Here again, it is important to note the source of the link between concentration and market structure. If Sutton is right, this link will be observed in those markets in which it is truly possible to differentiate one's product in the eyes of the consumer. More importantly, it is ***not*** the advertising that causes the concentration. It is the ability of advertising to differentiate products that leads jointly to both the large advertising expense and the concentrated industrial structure.[16]

There are numerous empirical studies linking advertising intensity to either profitability or concentration and the evidence on the relationship between advertising and concentration is quite mixed. Telser (1964) was one of the first studies to look for evidence of an advertising-concentration link. He found that, if anything, higher advertising was associated with *lower* industry concentration. Many other such studies soon followed. The findings of all these studies may be closely approximated by the summary statement that about half support Telser's original finding and half support the opposite view that advertising is positively associated with concentration. Moreover, as we have repeatedly emphasized, the interpretation of any such empirical findings is far from obvious. It may well be the monopoly power associated with highly concentrated industries that generates the heavy advertising expenditures, and not the high advertising expenditures that cause concentration to be high.

In light of the mixed empirical results on advertising and concentration, the case study evidence that Sutton (1991) provides seems the most compelling. Sutton finds that in those industries in which advertising might be reasonably expected to play a significant role in distinguishing one brand from another, such as breakfast cereals and frozen foods, advertising expenditures and the degree of concentration are both high. Perhaps the most interesting aspect of Sutton's argument is that, all else equal, the high advertising–high concentration link will likely be strongest precisely when price competition is the most intense. This is because, beyond the large sunk cost that the heavy advertising reflects, such fierce price rivalry further limits the number of firms that can profitably enter.[17]

[15] More precisely, the higher the *minimum* concentration ratio tends to be. This relationship is developed in section 4.2, Chapter 4.

[16] Schmalensee (1978) foreshadows this point. He considers a circular spatial model of a product differentiation with a few incumbent firms. The firms suppress price competition but compete heavily on advertising. In turn, the heavy advertising makes it impossible for new firms to enter because the consumer density is not enough at potential entry point to support such overhead expenditures. In other words, the price coordination leads to heavy advertising by incumbents such that there is no "room" left for a potential entrant.

[17] Robinson and Chiang (1996) also provide evidence in support of Sutton's basic analysis.

The famous *RealLemon* (1978) case is a good example supporting Sutton's argument.[18] Borden's RealLemon brand dominated the market for many years. When a rival firm, Golden Crown, entered the market with its own lemon juice product, which was chemically identical to RealLemon, it found itself at a real disadvantage relative to RealLemon, which had advertised heavily during the previous 10 years. Not only did Golden Crown have to sell at a 15 to 25 percent discount relative to RealLemon's price, but also substantial price competition broke out. The result was that RealLemon lowered its price and this in turn forced Golden Crown to do the same. Yet because of the price differential imposed on Golden Crown, it found that it could barely break even. Why? Because this was a product market in which consumers seemed particularly responsive to advertising, even though physical product differences were minimal. The heavy advertising in which the makers of RealLemon engaged gave rise to a very high market concentration. Because of the intense price competition there was a limit to the number of firms that could sustain the sunk costs of heavy advertising in this market.

The *Clorox* (1967) bleach case offers a further supporting example.[19] This case involved the proposed acquisition by Procter & Gamble of the Clorox bleach firm. Clorox was the dominant brand of household bleach accounting for nearly half of industry sales and selling for a substantial premium over rival brands despite the fact that all household bleaches are chemically indistinguishable. The courts found that Clorox's dominant position was due to its massive advertising. The Supreme Court considered such advertising to be a vital part of the market for household soaps, detergents, and cleansers. This view suggests that this was again a market in which differentiation by advertising was feasible and, hence, a market in which the equilibrium concentration level would be quite high, exactly as it was. Moreover, it appears again to be the case that this concentration was heightened as a result of the fierce price competition in the market. It was the fear of such intense price competition that led Procter & Gamble to prefer to enter this market by acquiring *Clorox* rather than by marketing its own brand.

21.5 COOPERATIVE ADVERTISING

Up until now we have focused on advertising as informational promotion of a firm's products with little concern about whether it is done by the manufacturer or the retailer. In fact, however, the provision of promotional services is one of the most crucial issues in the contractual link between these two parties. In recent years, new marketing arrangements broadly categorized as cooperative advertising agreements have emerged as a common feature of such promotional contracts. These practices are sufficiently novel and raised sufficient antitrust concerns that they are worth a separate investigation.

Cooperative advertising arrangements come in a variety of shapes and sizes. One type of agreement commonly used in book and music retailing is a simple one in which the manufacturer helps the retailer pay for advertising space in local media and also provides in-store displays and other promotional items. A closely related set of practices used frequently in the supermarket industry is the manufacturer's payment of "slotting allowances." These include

[18] *FTC v Borden, Inc*., 92 FTC 669 (1978). The FTC found Borden, the maker of the RealLemon brand guilty of monopolizing the reconstituted lemon juice market and that its successful differentiation of its product was the source of this monopoly power. The finding was later upheld by a U.S. Court of Appeals.

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

a lump-sum payment just to have one's product on the shelf. Slotting allowances can also include additional payments for end-of-the-aisle display stands in which a manufacturer's product is shown at eye level, so-called "pay-to-stay" fees which are essentially a form of rent, and failure fees that the manufacturer must pay when a product fails to achieve a pre-specified sales volume over say, a six-month period.

The competitive effects of all of these arrangements are complicated. To a large extent, they can enhance both efficiency and competition. By directly involving the manufacturer in promotional activities, they may mitigate the tendency for retailers to under-provide such services.[20] In addition, slotting fees have the beneficial effect of allocating scarce shelf space to those manufacturers who value it most highly as well as providing an incentive for the expansion of the most efficient retailers over time. Further, by putting more of the risk on the manufacturer, the failure fees may help overcome the reluctance of dealers to stock new products. In general, cooperative advertising agreements all reflect efforts to resolve the conflicts of interest that characterize vertical relationships. However, they do raise antitrust issues, as illustrated by three cases from the 1990s.

Perhaps the most obvious way that a cooperative advertising arrangement can be anti-competitive is when it is used by a large manufacturer to foreclose retail outlets to a smaller rival. Suppose for instance that a dominant manufacturer earns a profit of $10 million currently but that entry by a rival will reduce total industry profit to $8 million half of which goes to the new entrant. The incumbent is therefore facing a reduction of its profit from $10 million to $4 million if entry occurs. As a result, it will be willing to spend up to $6 million in slotting fees to retailers in order to keep the rival off the dealers' shelves. Since the most that the rival can pay is $4 million, the incumbent has a clear ability to outbid the rival and thereby to prevent entry.

The threat of foreclosure was at the heart of the Federal Trade Commission case against McCormick & Company, the world's largest spice company. McCormick sells a full line of prepared spices and related products such as dry seasoning mixes to supermarkets under its own name and, in different local markets, under the name of subsidiary brands. While there are other spice companies they are all much smaller than McCormick. In fact, only one of these, Burns Philp Food, Inc., sold on a national level and actually offered a full line of spices. In the early 1990s, Burns Philp began to price its products quite aggressively and a price war erupted between the two firms.

McCormick's tactics in the price war included the offering of generous up-front fees that were essentially the equivalent of paying slotting allowances. In return, McCormick demanded that the recipient store devote the vast majority of its spice shelf space—sometimes 90 percent or more—to McCormick products alone. Because not all stores either agreed to McCormick's demands or received exactly the same payments, the net amount for McCormick's products actually paid by a store was different across supermarkets. For this reason, the FTC's initial complaint was couched in terms of illegal price discrimination. However, there can be little doubt that the predatory foreclosure effect of buying up shelf space played a central role in the FTC's decision. The FTC noted that Burns Philp fared quite badly in the price war and that the loss of access to shelf space played a role in this outcome. It also noted that other competitors were now keenly aware of the danger of taking on McCormick. In the end, McCormick's agreed to stop paying differential allowances and to charge all grocery stores the same net price. While this solution addressed the price

[20] The under provision of retail services is discussed in section 18.4, Chapter 18.

discrimination issue, the question of foreclosure and what to do about it remained. However, this issue had become rather moot in the spice market by the time of the FTC's decision. By that time, Burns Philp had lost the price war.[21]

The FTC complaint against McCormick was largely couched in terms of illegal price discrimination that gave some grocery stores better terms than others. This is, in fact, the second way in which cooperative advertising agreements can be anticompetitive. This concern has been particularly strong in the book-selling market. Selling books is a tough business. There are over 150,000 books published each year. Even if the stock of each book is only a few thousand copies, these numbers imply a tremendous volume of books and a serious scarcity of shelf space at retail bookstores. This scarcity is obviously even more severe in the case of prime display locations at the front of the store, in the windows, and on the end of aisles. As this scarcity has intensified, shelf space and window displays have become prime real estate and publishers have paid fees ranging from $5,000 to $20,000 to have their books displayed in the window or on a popular shelf at consumer eye level.[22]

It is possible that payments for displays and for shelf space can be harmful when not all retailers are offered the same terms. This has been a persistent claim of independent bookstores. These outlets tend to be much smaller than the large discount chains. Hence, the "rent" a publisher will pay to such dealers for their top display spots is considerably less than that offered to the larger chain stores. Indeed, many small independent bookstores have complained that such cooperative advertising allowances are not available to them at all or that, if they are, the compensation they receive from publishers is lower and the reimbursement process is much more cumbersome. Accordingly, independent sellers have made repeated claims that the greater subsidization of the promotional costs at large chains allows the chains to sell their books at a lower price thereby giving the chains an unfair advantage.

If such price discrimination occurred and if it materially weakened competition it would, of course, be a violation of the Robinson–Patman Act. The difficulty with Robinson-Patman cases lies in distinguishing damage to competition from damage to individual competitors. That is, do the advertising subsidies damage the workings of the retail market or do they simply damage the small booksellers?

This question was the subject of both a lengthy investigation by the FTC and a number of lawsuits filed by the American Booksellers Association (representing over 4,500 independent bookstore owners) against the major publishing houses in the 1990s. In the end, the complaints were dismissed without any comment from the FTC on the legality of the practices. Instead, the FTC noted that the retailing of books was changing rapidly due to the rise of e-commerce giants like Amazon.com. The fierce rivalry that was emerging among electronic retailers made it difficult to argue that bookseller competition had been seriously threatened by publishers' cooperative advertising policies.[23] After the FTC ruling, the private lawsuits were quickly settled, usually with an agreement that each publisher make a small, lump sum payment to the independent booksellers and take modest steps to guarantee equal access of all bookstores to cooperative advertising.

[21] See "World's Largest Manufacturer of Spice and Seasoning Products Agrees to Settle Price Discrimination Charges," FTC News Release, March 8, 2000. See as well the case of *Avery Dennison Corp. v. Acco Brands, Inc*., Case No. Cv 99-1877 (Mcx), United States District Court For The Central District Of California, 2000 U.S. Dist.

[22] From J. Hitt, "The Theory of Supermarkets," *New York Times Magazine*, March 10, 1996, p. 61.

[23] See "FTC Dismisses Case against Six Book Publishers," FTC News Release, September 21, 1996, http://www.ftc.gov.

A third way that cooperative advertising can raise troublesome antitrust issues is when it is used as a means to implement what is effectively a resale price maintenance agreement. This concern is illustrated by a well-known case in the recorded music industry. At the time, this industry was dominated by five major companies: Sony, TimeWarner, EMI, Bertelsman, and Universal. Together these firms account for about 85 percent of U.S. sales of pre-recorded music. The firms distributed their CDs and tapes through both specialized retailers such as Musicland, Tower Records and Sam Goody, and sometimes through generalized retailers such as department stores. In the early 1990s, large discount sellers such as Best Buy Corp., Circuit City, and Wal-Mart entered the market.

In order to gain market share and establish a market presence, the discount stores entered with very low promotional CD prices. For some popular CDs, the price reductions were as much as 50 percent resulting in retail prices of under $10. Each of the five producers responded to this fall in retail prices by adopting cooperative advertising agreements with virtually all retailers. These agreements included a Minimum Average Price (MAP) clause. The typical arrangement called for the manufacturer to help fund the retailer's advertisements that did ***not*** mention prices below those that the manufacturer suggested. At least initially, however, the retail firm was free to run ads that mentioned lower prices so long as it did so at its own expense. This is exactly what some retailers did, especially the discount houses. They used the cooperative advertising funds for general promotion and then used their own funds to advertise their price cuts. The result was that the price war continued.

As time passed and retail CD prices stayed low, the music producers began to receive requests for lower wholesale prices from the traditional outlets, e.g., Sam Goody. These retailers justified such requests with the claim that lower wholesale prices would enable them to meet the discount competition. Thus, from the perspective of the CD makers, the intense competition at the retail level was spilling over into competition at the wholesale level. The five producers each then revised their cooperative advertising contracts. Starting in 1995, the agreements required that the retailer not mention a lower-than-suggested price *in any advertisement*, even those completely paid for by the retailer. Violation of this clause led to suspension of *all* cooperative advertising funding for 60 to 90 days. The spread of these contracts appears to have quickly ended discounting and led to a rise in both retail and wholesale CD prices.

In light of the foregoing, it is hard to escape the conclusion that the MAP agreements were primarily meant to enforce minimum resale prices. Moreover, the underlying motive does not appear to be the desire to guarantee the provision of retail services. What seems more likely based on the observed pricing behavior and company documents is that the primary purpose behind the MAP contracts was to suppress retail competition as a means to prevent the spread of such competition to the level of the five CD producers. In other words, the cooperative advertising appears really to have been a vertical arrangement designed to foster horizontal collusion. This was in fact exactly the judgment of the FTC, which found the five music producers to be in violation of the antitrust laws and ordered a stop to the MAP agreements. The five companies quickly complied with this order but the potential for this difficulty to rise again in another context seems clear.[24]

[24] See J. R. Wilke and P. M. Reilly, "FTC Investigates Retail Pricing of CDs, Seeks Data From Recording Companies," *Wall Street Journal*, May 7, 1997, p. B1. See also "Record Companies Settle FTC Charges of Restraining Competition in CD Music Market," FTC News Release, May 10, 2000, http://www.ftc.gov.

In fact, as Shaffer (1991) shows, lump sum slotting fee payments may play a similar role to the MAP agreements in weakening wholesale price competition. The argument is simple. In order to pay the slotting fee, the manufacturer has to set a wholesale price above marginal cost. Therefore, at the downstream level, each retailer who signs the agreement is effectively signaling its intention to be less aggressive in its pricing because it is accepting the higher wholesale price. Even if other retailers are aggressive, the firm with the slotting fee is compensated by the lump sum payment. As a result, each retailer has an incentive to adopt the slotting fee arrangement. This is in fact what happens in the Nash equilibrium. In turn, the weaker retail competition and higher retail prices also spills over to higher prices at the wholesale level.

In sum, cooperative advertising such as slotting fees and similar arrangements are examples of vertical contractual agreements. Almost certainly, these arrangements reflect attempts to deal with incentive conflicts between manufacturers and retailers and, for the most part, are probably either pro-competitive or neutral. Yet as with all vertical practices, there is also the potential for such agreements to have anticompetitive effects. As a result, while the courts typically apply a fairly generous rule of reason in such cases, they have not yet been comfortable with any sort of *per se* legal approach.[25]

21.6 EMPIRICAL APPLICATION
Advertising, Information, and Prestige

There has been considerable debate over the role that advertising plays in influencing consumer demand. Advertising could offer basic information, signal quality, or provide a complementary aspect of social status or prestige to the advertised product. While important insights come from exploring each of these approaches, the question of advertising's actual role may be ultimately an empirical one. It is difficult, however, to come up with good clean empirical evidence that identifies the nature of advertising's role. A relatively recent paper by Daniel Ackerberg (2001) does offer some interesting and promising results.

Ackerberg's (2001) paper studies the introduction of a new yogurt product by Yoplait, the second largest yogurt firm in the U.S. In April of 1987, the company introduced Yoplait 150 as its first entry into the low-calorie and low-fat yogurt product line. This period falls within the time frame of data collected by the A. C. Nielsen Co. for just under 2,000 households split roughly evenly between Sioux Falls, South Dakota and Springfield, Missouri.

Scanner data was used to monitor the shopping trips and purchases of these households. They also had TV meters installed in their homes that allowed Nielsen to monitor their television viewing and, hence, their exposure to Yoplait 150 advertising over the 12 months starting three months after the Yoplait 150 introduction, i.e., from July of 1987 to July of 1988, Thus, the data are a panel of observations covering consumers in two cities at weekly intervals over a one-year period.

Ackerberg (2001) considers two broad effects that advertising could have. The first of these is an information effect. Advertising may either inform consumers of the good's existence as in Grossman and Shapiro (1984), or signal quality or other information about the product's attributes, as in Nelson (1970) and Kihlstrom and Riordan (1984). In contrast, the Becker and Murphy (1993) model of complementary advertising and the advertising as persuasion

[25] See Klein and Wright (2007) for a recent discussion of these issues.

models suggest that the role of advertising is not informative but instead one that confers a separate recognition or prestige effect of its own. Ackerberg (2001) argues that if advertising plays an informational role then it should have little effect on experienced consumers. This is particularly the case if the relevant information is, as in Grossman and Shapiro (1984), simply about the existence and availability of the good. Once a consumer has bought it, they presumably know these facts so further advertising exposure will have no impact on them if, of course, this is the way advertising works.

This is also true but to a lesser extent if the information is about the quality of the product. Yoplait 150, for example, came out in many different flavors. It may take consumers a few tries to determine whether there is a flavor that they really like or not. In this case, advertising about alternative flavors will still have some effect on consumers over time, but one that should definitely diminish as they become more experienced with the product.

However, if advertising confers a prestige or recognition effect then there should be little distinction between its impact on experienced and inexperienced consumers. The complementary gains in consuming a well-recognized product should, on average, be the same whether a consumer is enjoying them for the first time or the tenth.

Ackerberg (2001) hopes to identify the role of advertising by distinguishing between its effects on experienced and inexperienced buyers. Two preliminary ordinary least squares (OLS) regressions suggest that this strategy may work. In these regressions, he looks at the total Yoplait 150 purchases over specific days in his sample and then divides these into two types. In one group are the sales that reflect first-time purchases. In the other group, are the sales that reflect repeat purchases, each measured as a fraction of the number of shopping trips that day. Ackerberg (2001) creates separate time series of first-time sales and repeat sales on specific market days over the 12-month period. For each of those making either a first or a repeat purchase, Ackerberg (2001) also has data on the average Yoplait 150 price for each market day (PRICE), and, for each purchase, the number of Yoplait 150 TV ads the buyer was exposed to in the last four days (ADS). Since Yoplait 150 generally sold much better in Springfield, he also includes a dummy variable (MARKET) equal to 1 if the data are from Springfield but 0 if they are from Sioux Falls. These preliminary results are shown in Table 21.1.

Observe first that the price effects are negative and statistically significant. Likewise, there is clearly a stronger preference for Yoplait 150 in Springfield than there is in Sioux Falls. Of most importance however, is the differential effect of advertising on the two types of expenditures. Recent advertising exposure has a far greater positive effect on first-time

Table 21.1 Effect of advertising and price on demand for new Yoplait product: preliminary results

	Dependent variable			
	Initial purchases		*Repeat purchases*	
	Coefficient	*Std. error*	*Coefficient*	*Std. error*
PRICE	–0.038	(0.013)[a]	–0.029	(0.014)[a]
ADS	0.030	(0.015)[a]	0.014	(0.017)
MARKET	0.002	(0.001)[a]	0.006	(0.001)[a]

[a] Indicates significant at the five % level.

buyers of Yoplait 150. In fact, the effect on repeat purchases is not statistically significant from zero. Thus, this evidence gives rough support to the idea that advertising provides information in that it has little effect on experienced consumers who, presumably already know of the existence and quality (taste) of Yoplait 150.

To get a deeper understanding of the role that advertising plays, Ackerberg (2001) exploits more fully the panel nature of his data and the variation among consumers that this implies. His approach, with some simplification, is to first hypothesize that the propensity of consumer i in period t to purchase Yoplait 150 (y_{it}^*) is a linear function of k different exogenous variables X_{it} and a random factor ε_{it}. That is

$$y_{it}^* = \sum_{j=1}^{k} \beta_j x_{jjit} + \varepsilon_{it}$$

However, one does not observe y_{it}^* directly. All one actually observes is whether consumer i at time t bought Yoplait 150 ($Y_{it} = 1$) or does not ($Y_{it} = 0$). The standard assumption in this case then is that we observe $Y_{it} = 1$ when $y_{it}^* \geq 0$, and $Y_{it} = 0$ when $y_{it}^* < 0$. This implies that the probability of observing a purchase $Y_{it} = 1$ is given by

$$\text{Prob}(Y_{it} = 1) = \text{Prob}\left[\sum_{j=1}^{k} \beta_j x_{jit} + \varepsilon_{it} \geq 0\right]$$

$$= \text{Prob}\left[\varepsilon_{it} > -\left(\sum_{j=1}^{k} \beta_j x_{jit}\right)\right] = 1 - F\left[-\left(\sum_{j=1}^{k} \beta_j x_{jit}\right)\right]$$

where $F()$ is the cumulative distribution of ε_{it}. It is convenient if $F()$ has a symmetric distribution so that $1 - F(-Z_{it}) = F(Z_{it})$. Then we have

$$\text{Prob}(Y_{it} = 1) = F\left(\sum_{j=1}^{k} \beta_j x_{jit}\right)$$

Clearly, much depends on the choice of the distribution of the random term ε_{it}. If ε_{it} is assumed to be distributed normally[26] one gets the Probit estimation procedure. A popular alternative is to assume instead that ε_{it} has a logistic cumulative distribution in which case:

$$F(Z_{it}) = \frac{e^{Z_{it}}}{1 + e^{Z_{it}}}$$

The reason for the popularity of this distribution is that this transformation implies that:

$$\ln\left[\frac{F(Z_{it})}{1 - F(Z_{it})}\right] = Z_{it}$$

[26] This assumption was made in the empirical applications in Chapters 13 and 19.

In other words,

$$\ln\left[\frac{F\left(\sum_{j=1}^{k}\beta_j x_{jit}\right)}{1-F\left(\sum_{j=1}^{k}\beta_j x_{jit}\right)}\right] = \ln\frac{\text{Prob}(Y_{it}=1)}{\text{Prob}(Y_{it}=0)} = \sum_{j=1}^{k}\beta_j x_{jit}$$

The ratio of the probability $Y_{it} = 1$ to the probability that $Y_{it} = 0$ is known as the odds ratio. By assuming a logistic distribution for ε_{it}, the logit estimation procedure assumes that the log of the odds ratio is a linear function of the key exogenous variables. This is a very convenient feature for estimation purposes.

Ackerberg (2001) presents a number of regressions based on the above logit procedure. The independent variables X_{it} include: (1) the amount (in time) of Yoplait 150 advertising the household has seen up to that time divided by the total time spent watching television, ADS; (2) the price of Yoplait 150 in the relevant market at that time, OWN PRICE; (3) a comparable measure of the average competitor's price, RIVAL PRICE; 4) the number of times (possibly zero) the household had purchased Yoplait 150 previous to that time, NUMBER PREV; and 5) the key 1,0 variable indicating whether the household had any previous purchases of Yoplait 150, EXPERIENCED or INEXPERIENCED.[27] Some of his main results are summarized in Table 21.2 below.

Consider the first regression results. Advertising has an important impact, but only for those who have not yet tried the new product. Again, this implies that advertising mostly plays an informative role. Specifically, the coefficient on the interactive term, ADS* EXPERIENCED captures the impact of advertising on consumers who know the quality of Yoplait 150 and therefore should reflect only complementary prestige or recognition effects. This coefficient is not statistically different from zero. In contrast, the coefficient on

Table 21.2 Effect of advertising and price on demand for new Yoplait product: final (logit) results

Independent variable	*Coefficient*	*Std. error*	*Coefficient*	*Std. error*
ADS[a] INEXPERIENCED	2.306	(0.776)[a]	—	—
ADS[a] EXPERIENCED	0.433	(1.212)	—	—
ADS	—	—	2.014	(0.790)[a]
ADS[a] (NUMBER PREV)	—	—	–0.356	(0.108)[a]
NUMBER PREV	–0.267	(0.093)[a]	–0.270	(0.092)[a]
(NUMBER PREV)	0.009	(0.001)[a]	–0.001	(0.001)
OWN PRICE	–5.584	(0.350)[a]	–5.616	(0.356)[a]
RIVAL PRICE	0.761	(0.217)[a]	0.768	(0.219)[a]

Dependent variable: purchase (or not) of Yoplait 150 by household i at time t. [a] Indicates significant at 5% level

[27] Household size and income and, as before, a market dummy for Springfield households were also included. Ackerberg (2001) also includes a random, household-specific intercept to control for household heterogeneity in time-persistent preferences for the product.

ADS*INEXPERIENCED reflects both prestige and information effects. It *is* statistically different from zero and this suggests that the information effect is behind this since our estimate of prestige effects is not distinct from zero.[28]

The second regression tries to discriminate more between the two types of information that advertising provides. In the first regression, the assumption is that a household becomes fully informed after just one purchase of Yoplait 150. This would likely be the case if the important information provided by advertising were simply knowledge of the good's existence and availability. Once a household has bought the product, it presumably knows these features of the product. Learning brand characteristics such as taste, calories, and so on may take a little longer and may be facilitated by continuing advertisements. For this reason, the regression includes ADS alone as an independent regressor, but then also includes this variable in an interaction term with NUMBER PREV, the number of prior purchase of the Yoplaint 150. The idea is that the pure effect of advertising measured by ADS will decline as the consumer's experience grows. The more rapidly this decline occurs, the more likely it is that the primary information obtained from advertising is existence and availability. The more slowly it declines, the more likely that the information provided concerns product attributes that take time to learn. Sure enough, the coefficient on ADS*(NUMBER PREV) is negative but a relatively small – 0.36. This implies that it takes 6 or 7 purchases of Yoplait 150 before the advertising information is no longer useful. As noted, this implies that part of the information provided concerns product attributes.

Are these coefficient estimates sensible? It is difficult to say immediately since the coefficients in the logit model relate to the effect of advertising on the *probability* of purchase and not directly to demand itself. However, there are some aspects of the results that give us confidence in the findings. First, in each case, the price of Yoplait 150 had a strong negative impact and the rival's price a strong positive effect on a household's purchase decision. Second, one can simulate the model to see what overall demand features the price and advertising coefficients imply. When Ackerberg (2001) conducts such simulations with the full model he finds that, taken at the mean, the own-price elasticity of demand is 2.8—a fairly elastic response. He also finds that the elasticity of demand with respect to advertising is 0.15. Taken together, the advertising and price elasticities would imply, by virtue of the Dorfman-Steiner condition, an advertising-to-sales ratio of 0.15/2.8 = 0.054 or 5.4 percent. This is a quite reasonable result given that Yoplait's overall advertising-to-sales ratio was reported at the time to be about seven percent. Overall then, Ackerberg's (2001) findings seem to be quite plausible.

In short, the evidence from Ackerberg (2001) is that the primary role of advertising is to provide consumers with information. Some of this information is simply making consumers aware of the product's availability, but some of it concerns educating consumers about the product's key features. There is little evidence that in this particular market advertising provides prestige or recognition effects. The data are based however on a perishable consumer food product purchased with some frequency. Whether it applies to other more durable consumer goods, or to goods such as medications that consumers buy less frequently, merits further investigation.

[28] To be precise, the difference between the two coefficients, ADS*INEXPERIENCED and ADS*EXPERIENCED is a direct estimate of the pure information effects. Standard techniques yield a *t*-statistic for this difference of about 1.5.

Summary

Advertising by manufacturers can play a useful role in informing consumers of real differences in product attributes. For example, within the market for painkillers, some consumers can benefit from the anti-inflammatory effects of aspirin. Others find aspirin too abrasive to the lining of their stomachs. For these customers, knowing that aspirin alternatives are available such as Tylenol with acetaminophen and Advil with ibuprofen is important. In all markets in which consumers have a strong taste for variety, informative advertising improves the matching of consumers with the product types they most prefer.

There are also many goods such as films, clothes, cosmetics, watches, vacation packages and hiking shoes where promotional efforts may be useful because they serve as a complement to the product being advertised. For example, one's enjoyment of a new movie is often greatly enhanced if, after viewing it, one can talk about the film with friends who will at least know a bit about the film such as the plot and the star performers. The same is true for the purchase of designer clothes. There is little status in wearing clothes designed by Calvin Smith no matter how good they are. There is considerable crowd appeal in wearing those designed by Calvin Klein. By providing such complementary services, advertising can again enhance consumer welfare.

Advertising may improve social welfare and economic efficiency. Nevertheless, advertising still raises important public policy issues. There remains the question as to whether the market generates too little or too much advertising effort. A case can be made for either view. In addition, the advertising agreements between manufacturers and retailers could be used to suppress both retail and wholesale price competition. All of this is a way of saying that advertising raises complicated issues that do not give rise to broad general statements. This is not to say that the frustration with advertising shared by TV viewers and many others that we identified at the start of this chapter are not real. What the analyses presented here do suggest though is that without any advertising at all there would likely be a different but equally real set of frustrations.

Problems

1. A recent survey by an advertising agency found that many consumers thought that there were too many different brands available for sale in certain product categories. For example, 70 percent of the consumers surveyed thought that there were too many brands of dry cereal, and 60 percent thought that there were too many brands of bar soap. Explain what is meant by the phrases "too many" or "too few" from the point of view of efficiency. Explain how the market could lead to "too many" brands of a product being produced?

2. There are the two hair salons located on Main Street, which is one mile long. The low-cost salon, Quick-Cuts, is located at the east end of town, at the address $x = 0$. It has a constant unit cost of \$6 for a "haircut." The higher cost salon, Le Coupe, is located at the west end, or $x = 1$. The unit cost of a "haircut" at Le Coupe is \$18. There are 1000 potential customers distributed uniformly along Main Street. Consumers are willing to pay \$50 for a "haircut" if it was done at their home. If a consumer has to travel to get a "haircut" then a travel cost of \$$t$ per unit mile is incurred. Suppose that t = \$12/mile. Each salon wants to set a price for a "haircut" that maximizes the salon's profit.
   a. What is the demand function facing Quick-Cuts? What is the demand function facing Le Coupe?
   b. What are the equilibrium prices set by the two salons?
   c. What are the market shares of the two salons at these prices?

3. Return to problem 2, above.
   a. What happens to equilibrium prices and market shares if travel cost t increases from \$12 to \$20 per mile?
   b. What happens to equilibrium prices and market shares if the travel cost t decreases from \$12 to \$6 per mile?

4. Suppose now that consumers are not perfectly informed about where the salons are and what prices are charged for a "haircut."
   a. Which salon do you think has the greater incentive to advertise? Why?
   b. The incentive to advertise of course depends upon the cost of advertising. Let's suppose that Le Coupe is working with a more effective ad agency and so the cost of reaching consumers, as for example measured by the parameter α, is lower for Le Coupe than for Quick-Cuts. In particular suppose that the proportion of consumers along Main Street that are informed of a "haircut" at Quick-Cuts is $^1/_2$, whereas the proportion of consumers informed about Le Coupe is $^3/_4$. What happens to equilibrium prices?

5. Consider the following list of ad campaigns: evaluate them according to extending reach or building value:
   a. promoting a quicker braking for a specific type of tire;
   b. presentation of taste test data on French fries;
   c. presentation of sales data on a cola product;
   d. demonstration of a close shave by an attractive well-known athlete;
   e. a dog taking its owner to a particular car dealership;
   f. testimonials by adults who like a "kid's" cereal;
   g. laundry detergent commercial showing items washed by two different brands;
   h. liquid soap commercial showing celebrity lathering themselves;
   i. athletic apparel commercial showing big stars being provocative.

6. Consider again Practice Problem 21.3 only now the inverse demand curve is $P(Q, \alpha) = 1 - \alpha^{-1/2}Q$, where Q is number of tubes sold per period, measured in millions, and α is advertising seconds on television per period. Currently the firm is advertising 100 seconds. The cost of advertising is \$10,000 per second. The production cost of a tube of gel is constant and set to zero and there are no fixed costs.
   a. Calculate the firm's profit-maximizing quantity and price. Work out the firm's profit as well.
   b. Now suppose that the firm's marketing manager has struck a deal that if the firm advertises 625 seconds the cost of advertising falls to \$5,000 per second. Work out what the firm's profit maximizing strategy and profits if it increases it advertising to 625 seconds.
   c. Compare your answer to that for the Practice Problem.

7. Let there be two firms, 1 and 2. Each firm sells a product of innate quality level 1 and each chooses its price, p_1 and p_2, respectively. However, firm 1 also gets to choose an advertising level a_1. Consumers perceive product quality to be the product's advertising level times its innate quality. In other words, consumers perceive product 1 to be of quality a_1 and product 2 to be of quality 1. Consumers are indexed by θ distributed continuously from zero to 1. θ_i is consumer i's willingness to pay for quality. Consumer i's net gain from consuming product 1 is $\theta i a_1 - p_1$, while consuming product 2 generates a net gain of $\theta_i - p_2$. There is no production cost. However, firm 1 incurs advertising cost of $(a_1/2)^2$.
   a. Assume all N consumers always buy the product of either firm 1 or firm 2, i.e., the market is always covered. Show that the marginal consumer indexed by θ^m satisfies: $\theta^m a_1 - p_1 = \theta^m - p_2$.
   b. Derive the equilibrium values of p_1, p_2, and a_1.
   c. Suppose firm 2 is permitted now to advertise at any positive level a_2 between 0 and 0.5. What level of advertising will it choose if it takes firm 1's choice a_1 as given?

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