



Part Six

Non-Price Competition

So far, most of our analysis has focused on interfirm competition centered on quantity or price. However, firms compete in many other dimensions, as well. Two such competitive mechanisms are advertising and innovative effort. These are the topics addressed in Part Six.

Advertising has long been an issue of both academic and popular concern. Initially, economists focused on the use of advertising to build brand loyalty and thereby to soften price competition between different brands. However, subsequent analysis has focused on the informational role of advertising. By helping consumers learn what alternatives are available and at which prices, by informing consumers about the appropriate uses of a new product and its overall quality, and in numerous other ways, advertising can play a useful role in improving the welfare of both producers and consumers. In Chapter 19 we examine many economic models of advertising. We also present Akerberg's (2001) empirical paper offering evidence on the critical role that advertising plays as information regarding what products are being sold and what their critical features are.

In Chapter 20, we consider the general issues of innovation and Schumpeterian competition. Chapter 20 begins with a presentation of a well-known set of propositions typically referred to jointly as the Schumpeterian hypotheses. This is that large firms and concentrated industries are necessary for technological innovation. This chapter explicitly addresses the nature of R&D competition and precisely the sort of market structure that most encourages technical progress. We also explore the potential gains and losses when firms cooperate on R&D activity, and review empirical evidence on the Schumpeterian hypotheses. We conclude with a consideration of the evidence on the spillovers from one firm's R&D to another's as found in the empirical work of Keller (2002).

In Chapter 21, we consider public policy designed to encourage R&D, especially patent policy. Such policy must walk a thin line between granting wide access to available technologies and yet also giving innovators the rights to restrict such access so as to earn a return on their inventions. We discuss recent patent policy developments and, in particular, the rise of the so-called "patent thicket." We also note the issues that arise in a patent system when patents are issued sequentially, and all patents are needed to pursue further innovation. The empirical study for this chapter is the Hall and Zedonis (2001) paper on innovation in the semiconductor industry.

Advertising, Market Power, and Information

Large retail stores that sell many different kinds of goods and many different brands of each good are a relatively recent phenomenon in the history of commerce. A customer buying, say, a pair of shoes in the early twentieth century would have faced a different shopping experience from the one faced today. The consumer would have been restricted to making a purchase in a specialized shoe store carrying only one or at most two brands, or possibly a cobbler's shop that made its own shoes. In addition, the consumer of a hundred years ago would have had to consult with the store proprietor, and would not have been able to examine and compare the merchandise directly.

How different the modern shopping experience is from the practices of the not-so-distant past. Today's consumer can go to a shoe or department store and see a whole range of different brands. Once there, the consumer can personally handle and inspect each different style without any need to deal with a store employee. Only when the consumer decides actually to try a specific pair of shoes on will the assistance from a store employee be required—and even that is not always necessary. Consumers now may choose directly from an even wider range of different brands and never deal with a sales representative when they purchase shoes over the web.

What has made this dramatic change in the nature of retailing possible? Our reference to the web provides a clue. The retailing revolution of the twentieth century that has continued to the digital commerce of the twenty-first owes much to the advent of mass media. Beginning with radio, then television, and now the Internet, technological change in telecommunications has made it possible for manufacturers to reach their consumers en masse and promote their products directly to the public. With wide scale advertising, manufacturers themselves can promote their products directly to a wide target audience. In turn, this has facilitated the formation of large-scale retail establishments such as department stores, discount stores, and web-based retailers like Amazon, each selling several varieties of hundreds of different kinds of goods. Mass communication and large-scale advertising have developed hand-in-hand, leading to a sustained dramatic change in the way consumers learn about the products that are out there waiting for them to buy.¹

¹ For a good discussion of this revolutionizing effect of modern advertising and other aspects of advertising and promotional activities, see D. Pope, *The Making of Modern Advertising*, (1983).

Yet while it is clear that the emergence of large-scale advertising has played a crucial role in the development of retailing, the full nature of advertising's impact remains a puzzle. We do not know exactly how advertising affects the consumer's decision of whether to buy and if so, what brand to buy. Consider, for example, television ads for Nike shoes. These ads often say little about the nature of the shoes and instead just feature a collage of images accompanied by the Nike Company's famous "swoosh" logo. How does this affect a consumer's decision to buy? In some Nike ads the company expressly points out that it is a corporate sponsor and apparel provider for the US Olympic team. How does this affect the consumer's decision of whether to purchase Nike shoes?

The question as to how ads like those run by Nike actually work is important for many reasons. To begin with, Nike is not alone. Its promotional efforts are typical of many firms marketing consumer products and these efforts are very costly. Advertising on network television, for example, can cost millions of dollars for a single minute of airtime. For the 2013 Super Bowl the average price of a 30-second spot was a record-breaking \$3.75 million, with some spots going for over \$4 million and all spots sold more than a month before the Super Bowl itself.² Still, Anheuser-Busch InBev, Frito-Lay, Pepsi-Cola, Proctor & Gamble, and others all bought spots for that game. We would like to understand first how advertising works in order to understand the incentives for these firms to incur such costs. At that point we can examine the decisions of firms to promote their products and why firms in some industries do much more advertising than those in others. Understanding how advertising works allows us to move on to investigate how advertising affects the strategic interaction between firms, and what this means for the consumer.

Our goal in this chapter is to understand the role of advertising and the implications that this carries for strategic interaction in the market place and consumer welfare. Advertising is provided by both manufacturers, e.g., Nike, and by retailers, e.g., Target. As a result, the provision of promotional services involves many of the vertical incentive conflicts that we have discussed in the previous two chapters. For the most part, we will suppress the distinction between manufacturer and retailer and focus on how advertising affects consumer buying decisions and the strategic interaction among firms competing for the consumer's patronage. We are interested in how advertising works, what information or other features advertising provides that induces consumers to buy the advertised brand, and what impact advertising has on the market.

Advertising could be viewed as an integral element of competition among firms that sell different brands of the same good. In this case, high advertising could be considered a sign of good health—a way to increase consumer awareness of different brands and therefore a vital component of healthy competition. In contrast, advertising could be seen as a way to differentiate one manufacturer's brand from another and thereby weaken competition by making it less likely that a consumer will switch brands. High advertising in this case would be a sign of market power. There is a long-standing policy concern that advertising expenditures overall could be socially wasteful (see Reality Checkpoint and Appendix)—in that each firm's effort to switch consumers to its brand just offsets its rivals' so that these expenditures yield no net gain to any firm. Our analysis should provide a better understanding of this issue as well. However, gaining insight into whether there is too much or too little advertising requires that we learn the underlying economic logic behind advertising. Why do firms do it and how does it work?

² S. Elliott, "Super Bowl Commercial Time is a Sellout," *New York Times*, January 8, 2013, p. B3.

Reality Checkpoint

The Brush War in Hog Heaven

Perhaps one of the clearest examples of a “prisoners’ dilemma” advertising war comes from the 1990’s rivalry between Braun and Optiva, the two biggest makers of electric toothbrushes. While the rivalry between these two firms has witnessed many intense episodes over the years, perhaps none was so extraordinary than that in late 1999. In an effort to win market share for its *Sonicare* brand, Optiva hired a crack dental research team to conduct tests showing that *Sonicare* toothbrushes were both less abrasive and better at attacking bacteria below the gum line than Braun’s *Oral B Plaque Remover* model. This was quite expensive because the tests were conducted by repeatedly brushing the teeth of 3,000 dead pigs, which required the purchase of the pig heads from slaughterhouses and then arranging for

the transportation and refrigeration of those heads in storage.

Braun responded quickly. It sent a team of scientists to Kansas to brush the teeth of a large number of *living* pigs. To do this, it not only had to pay the farmers but also arrange for the sedation of the swine because hogs are not eager to have their teeth cleaned electronically.

The whole affair was very expensive. Indeed, the resultant claims and counter claims ultimately led to a court battle and more costs. In truth, it is hard to know how relevant the brushing of pigs’ teeth is to human oral hygiene. It was easy to see though that this war was bad for the health of both firms’ profits.

Source: M. Maremount, “Braun, Sonicare Brush Up on their Legendary Feud,” *The Wall Street Journal*, April 30, 1999, p. A1.

19.1 ADVERTISING: PRACTICE AND THEORY

The phenomenon of advertising is something of a paradox. Promotional efforts such as TV commercials are often barely tolerated by social critics. Advertising is frequently disparaged as something that is wrong with contemporary society—something that tricks us into wanting and even buying things we don’t need. At the same time, advertising is ubiquitous. It airs on our television sets and radios, accounts for many of the pages in magazines and daily newspapers, dots the landscape and cityscape with billboards, and even shows up on our T-shirts and other apparel. However, much one might be critical of advertising, it seems that we can hardly live without it.

The magnitude of the advertising phenomenon as reflected in total dollars of expenditure is substantial. From the 1950s to 2008, total expenditure on advertising in the United States has consistently amounted to roughly 2 percent of the gross domestic product.³ This has fallen somewhat in the wake of the Great Recession that began in late 2007. Thus, in 2011, while total US advertising expenditures were a quite substantial \$250 billion, that amounted to only 1.65 percent of that year’s GDP. Of this amount, nearly two-thirds was for measured media advertising. This includes spending on nationwide broadcast and cable television networks, radio networks, national magazines, newspapers, yellow pages, and the Internet. The other one-third is non-measured, or only indirectly measured media spending. This category includes expenditures on direct mailings, promotions, coupons, catalogs, business

³ Data on advertising expenditures are from Advertising Age Data Center, adage.com.

publications, and the sponsorship of special events. Retail advertising is often more heavily concentrated in non-measured media spending.⁴

Firms differ substantially in their advertising behavior. Based on measured media advertising in the United States, Procter & Gamble was the largest 2011 advertiser, spending \$2.9 billion. However, telecommunications firms such as AT&T, Verizon, and Comcast all spent well over \$1 billion, as did the reborn car makers General Motors and Chrysler, and each of these firms was among the top ten advertisers of 2011. In contrast, Apple computers was some way down the list with total expenditures of \$62 million.⁵

In order to compare advertising efforts across firms of different sizes we typically compute advertising expenditure as a percentage of sales revenue. Even looking at this fraction—the advertising-to-sales ratio—still leaves considerable variation among firms, however. In 2011, the ratio for Procter & Gamble was about 11 percent, whereas for Apple computer it was closer to 1 percent. For most automakers, the advertising-to-sales ratio is on the order of 2 to 3 percent. Within the pharmaceutical industry, Pfizer's measured advertising spending came close to 9 percent of its sales revenue. Yet its rival Merck was closer to 3 percent. Johnson & Johnson, which is both a pharmaceutical maker and medical equipment manufacturer, had a 2011 advertising-to-sales ratio of about 5.2 percent.⁶

In sum, we see significant differences in advertising intensity between industries and even between firms in the same industry. The clear implication is that advertising is a strategic variable chosen by individual firms in response to their perceived strategic environment. To understand that choice—and its implications—we need to consider that environment and precisely how advertising works in that setting.

19.2 ADVERTISING AND MARKET POWER

As we noted earlier, economic research on advertising has been a long-running enterprise. Indeed, even Alfred Marshall (1890) devoted some consideration to advertising and its ability to facilitate the exploitation of scale economies.⁷ Much of the earliest work, however, came in the early post World War II period and this drew a fairly negative assessment that advertising is a socially wasteful way for firms to compete that tends to foster market power [Kaldor (1950), Galbraith (1958), Solow (1967)].⁸ One notable study in this last regard is that by Nichols (1951) of the American cigarette market. Nichols provides statistical evidence that the major brands relied heavily on advertising to differentiate their products and thereby soften price competition, especially that of “penny cigarettes.”

Two further studies that were particularly influential—both with deep roots in the Structure-Conduct-Performance framework—were those of Bain (1956) and Comanor and Wilson (1967). Bain (1956), found that both concentration and profitability were positively linked and that, in turn, the central factor preserving concentration was the barrier to entry provided by intense advertising that differentiated incumbent products from those of potential new entrants. Similarly, using a somewhat more sophisticated regression analysis, Comanor and Wilson (1967) found that industries with high profitability are

⁴ Expenditures on measured media is tracked by TNS Media Intelligence.

⁵ Advertising Age, 2013 Annual.

⁶ Ibid.

⁷ A modern exposition of this view is found in Bagwell and Ramey (1994).

⁸ Viewed in this light, advertising is much like rent-seeking behavior. See, for example, Posner (1975).

closely associated with those that have a high advertising to sales ratio. This result was soon replicated in several similar studies for different time periods and different countries.⁹

However, in examining any link between advertising and market structure, we again need to remember that both are potentially endogenous variables. Advertising may foster concentration and market power but market power may equally be at least as an important determinant of advertising. We therefore need to separate out the causality in understanding any connection between the two. Moreover, if advertising does work by changing consumer tastes then calculating its effects requires that we think carefully about how it does this and what this implies for the benefits that consumers derive from the product.

19.3 THE MONOPOLY FIRM'S PROFIT-MAXIMIZING LEVEL OF ADVERTISING

Rational firms will only expend considerable resources on advertising if it is profitable to do so. Because advertising is costly, this means that it must generate revenue to cover those costs. In other words, advertising must affect demand. It is useful in this respect to recall that any firm with market power faces a downward sloping demand curve. The firm is interested in pushing its demand curve out and selling more at the same price rather than selling more by lowering its price and moving down along the existing demand curve. So, one way of thinking of how advertising works is that advertising shifts the firm's demand curve. In other words, demand depends not only upon the price the firm sets but also upon the amount of advertising that the firm chooses. This can be described by the general inverse demand function: $P = P(Q, \alpha)$ where P is the product price and α is the amount of advertising, measured for example as seconds of television or radio time, or perhaps as page space in newspapers or magazines per period. As usual, we assume that for a given level of advertising, the firm's demand falls as the price P rises, i.e., to sell more output Q requires that the price P fall. Consistent with our assumption that advertising shifts the demand curve outward, this means that we may assume that for a given output Q , the price consumers are willing to pay rises as the amount of advertising increases. The inverse demand function $P = \alpha(A - BQ)$ is an example of a demand relation that would satisfy these requirements.

Whatever the specific demand function, the ability of advertising to increase demand is the "good news" of advertising. The "bad news" is that advertising is costly. We will assume that every unit of advertising or advertising message costs the firm c_α ¹⁰ and that every unit of production costs the firm c_G . It then follows that the firm will earn a total profit $\pi(Q, \alpha)$ given by:

$$\pi(Q, \alpha) = [P(Q, \alpha) - c_G]Q - c_\alpha \alpha \quad (19.1)$$

The firm's profit maximization strategy now involves two choices. It must pick a both a level of output Q and a level of advertising α that together maximize profit. Yet while the profit-maximization decision now has two dimensions, we can still use some of our basic insights from our earlier work to determine the implications of such profit-maximizing

⁹ See, for example, Lambin (1976), Geroski (1982), and Round (1983).

¹⁰ 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.

behavior. To begin with, we know that given an optimal amount of advertising α^* , the firm's optimal output Q^* will need to satisfy the requirement that given that advertising level, marginal revenue equals marginal production cost c_G at Q^* . In turn, we know from our work in Chapter 4 that this implies that the firm's price-cost margin as measured by the Lerner Index be equal to the inverse of the price elasticity of demand. That is, a necessary condition for the firm to be setting the optimal price P^* (producing the optimal output Q^*) is:

$$\frac{P^* - c_G}{P^*} = \frac{1}{\varepsilon_P} \quad (19.2)$$

where $\varepsilon_P = \frac{\Delta Q/Q}{\Delta P/P} = \frac{P}{Q} \left(\frac{\Delta Q}{\Delta P} \right)$ is the price elasticity of demand evaluated at the firm's optimal price choice P^* and conditional, as noted, on the given level of advertising α .

Now consider the monopoly firm's optimal amount of advertising, or α^* . At any given price P the firm's corresponding output Q will rise if advertising α also increases, i.e., $\frac{\Delta Q}{\Delta \alpha} > 0$. This extra output will generate additional profit of $(P - c)$ per unit. So, the total net revenue from an increase in advertising α is just: $(P - c_G) \frac{\Delta Q}{\Delta \alpha}$. The firm will therefore wish to keep raising its advertising, keep raising α , up to the point where this net revenue increase just covers the marginal cost. Therefore, an additional condition that the firm must meet is that it choose an optimal amount of advertising such that:

$$(P - c) \frac{\Delta Q}{\Delta \alpha} = c_\alpha \quad (19.3)$$

If we now divide both sides of equation (19.3) by total sales PQ and multiply both sides by total advertising α , we then obtain:

$$\frac{(P - c_G)}{PQ} \frac{\Delta Q}{\Delta \alpha} \alpha = \frac{c_\alpha \alpha}{PQ} \quad (19.4)$$

Note that the right-hand side of equation (19.4) is the ratio of total advertising expense $c_\alpha \alpha$ to total sales PQ , i.e., the standard advertising-to-sales measure of the firm's advertising intensity. We may get some insight into the left-hand-side by rewriting equation (19.4) as follows:

$$\left(\frac{P^* - c_G}{P^*} \right) \frac{(\Delta Q/Q)}{(\Delta \alpha/\alpha^*)} = \frac{c_\alpha \alpha}{PQ} = \frac{\text{advertising expense}}{\text{total sales}} \quad (19.5)$$

where we have now indicated that this condition must also hold when the firm chooses both the optimal price P^* and the optimal advertising effort α^* . From equation (19.2) we know that at this optimum the first term on the left-hand side of (19.4) is the inverse of the price elasticity of demand ε_P .

Now consider the second left-hand-side term $\frac{(\Delta Q/Q)}{(\Delta \alpha/\alpha^*)}$. As a little thought quickly reveals, this term captures the proportional change in the quantity demanded $(\Delta Q/Q)$ in response to a proportional change in advertising effort $(\Delta \alpha/\alpha^*)$ measured at the optimal

level of α . Hence, it is naturally interpreted as the elasticity of demand with respect to advertising ε_α . Thus, we may now write equation (19.5) quite simply as:

$$\frac{\varepsilon_\alpha}{\varepsilon_P} = \frac{\text{advertising expense}}{\text{total sales}} \quad (19.6)$$

We now have a key result. The firm with market power maximizes profit by choosing a price (or output level) and a level of advertising such that the ratio of advertising expenditure to sales is just equal to the ratio of the advertising elasticity of demand to the price elasticity of demand. This result is usually referred to as the Dorfman-Steiner condition after the pioneering paper on advertising written by Dorfman and Steiner in (1954).¹¹ It makes clear that whatever effect advertising efforts may have in creating and preserving market power, basic theory implies that there is a direct causal link between a firm's market power as measured by its Lerner Index and the amount of advertising the firm does. Specifically, firms with greater market power facing less elastic demand and therefore able to set a higher markup of price over cost will be firms that do more advertising. In turn, this means that any positive correlation we see in the data between a measure of market power and a measure of advertising intensity does not by itself mean that the higher advertising is causing the greater market power. Instead, it may well be the case that it is the greater market power leading to the greater advertising. Think of it this way. A perfectly competitive firm is a price-taker that faces an infinitely elastic demand. Equation (19.6) therefore implies that such a firm should have an advertising-to-sales ratio of zero, i.e., it should do no advertising. The underlying intuition is that the perfectly competitive firm can sell all that it wants to at the current price. It does not need to advertise and "push out" its demand curve to sell more. It is only those firms with less elastic demand that, in the absence of increased advertising, can only sell additional units by lowering the price that have the real incentive to advertise.

19.1

Practice Problem

Suppose that a monopoly firm faces an inverse demand curve described by $P(Q, \alpha) = 100 - \frac{1}{\sqrt{\alpha}}Q$. The firm has a constant marginal production cost equal to 60. Each advertising message costs the firm \$1.

- What is the slope of the demand curve when $\alpha = 100$? When $\alpha = 1000$? Illustrate your answers.
- Suppose that firm decides to send $\alpha = 2500$ advertising messages.
 - What is the monopolist's marginal revenue curve?
 - What will be the monopolist's profit-maximizing price and output values?
 - What is the price elasticity of demand at this price and output combination?
- The demand function is such that the advertising elasticity of demand is constant at $1/2$. Do the price and output combination derived in part (b), satisfy the Dorfman-Steiner condition?

¹¹ Dorfman, R. and P. Steiner, 1954. "Optimal Advertising and Optimal Quality," *American Economic Review* 44: 826–36.

19.4 THE ECONOMIC ROLE OF ADVERTISING

It is clear from the foregoing that the market environment is a key determinant of firms' advertising choices. Yet as noted, there is a long intellectual tradition arguing the reverse—that advertising itself has an important impact on the competitive setting, especially as it affects barriers to entry. Whether and if this is the case, depends in important ways on just precisely how advertising works to increase consumer demand. Does it truly alter consumer preferences? Or does it merely provide information about the availability and price of goods?

19.4.1 Advertising as Consumer Persuasion

As noted, a very common view of advertising is that it actually changes consumer preferences in favor of the advertised good. Consumers are thereby induced to purchase more of a particular brand than they would have in the absence of advertising. This is reflected in an outward shift in the demand curve for the advertised good.

Evaluating the impact of persuasive advertising is tricky on several counts. To begin with, some of the persuasion may be based on fraudulent claims. Indeed, an important reason for the creation of the Federal Trade Commission (FTC) was to protect consumers against false or deceptive advertising characteristic of “snake oil” sales pitches of the late nineteenth and early twentieth century. Even today, the FTC's Consumer Protection Division is one of its busiest. In 2012, the division forced Oreck to cease advertising its claim that its vacuum cleaners and air purifiers could prevent the flu, and required Nivea to halt advertising that its *My Silhouette!* skin cream could help users lose weight. Both Oreck and Nivea paid fines as well. In the case of the shoe company, Reebok, the FTC not only forced the firm to stop advertisements that claimed its “toning shoes” provided extra tone and strength to leg and buttock muscles, but also required the firm to issue \$25 million in customer refunds. As these were just some of the hundreds of deceptive advertising complaints that the FTC handled, it seems clear that fraudulent persuasive advertising is a real phenomenon. In these cases, any outward shift in the demand curve is likely to prove temporary as consumers learn of the product's true qualities.¹² We return to this issue below in our discussion of advertising as information (or misinformation).

More importantly, the view that advertising changes consumer preferences raises difficult issues in economic analysis as the usual assumption is that preferences are given. That is, we usually assume that the consumer has a given utility function that reflects tastes and that determines the consumer's willingness to pay for different goods and services. If we are to assert that advertising can change these tastes, then the calculation of consumer surplus and welfare measures becomes complicated.

Two approaches are described in Dixit and Norman (1978). Both may be illustrated by Figure 19.1. Here D_0 is the demand curve that reflects consumers' innate tastes before any advertising, while D_1 is the demand curve that reflects those tastes as altered by

¹² The demand shift may last longer in some cases. For example, in the case of negative options such as used by book clubs and credit card protection services, among others. In these cases, the advertiser persuades the consumer to make an initial purchase, e.g., to try 30 days of credit card protection. The catch is that after 30 days, the customer continues to receive and to pay for the service unless the customer explicitly indicates that it is no longer wanted.

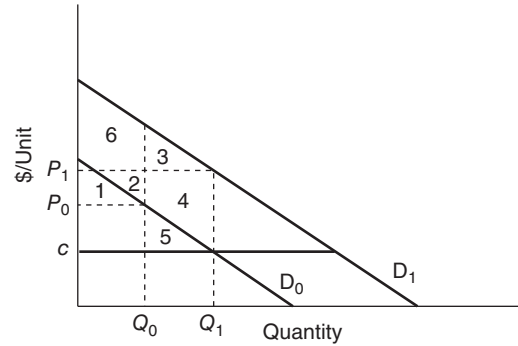


Figure 19.1 Welfare analysis of persuasive advertising

persuasive advertising. As shown, the advertising has shifted out the demand curve and led to both an increase in price (from P_0 to P_1) and an increase in the quantity purchased (from Q_0 to Q_1).

Suppose we take the view that it is the original demand curve D_0 that is the relevant one for analyzing welfare. In this view, the advertising clearly makes consumers worse off. They now pay more for the initial amount that they were buying—a loss captured by the sum of areas 1 and 2 in the figure. In addition, they now buy an additional $Q_1 - Q_0$ goods at price P_1 that they do not truly value at that price. This loss is reflected in area 4. Thus, in total, consumers lose areas $1 + 2 + 4$. Note though that this sum also reflects an equal gain in producer surplus. That is, areas $1 + 2 + 4$ reflect not a deadweight loss but, instead, a transfer from consumers to producers. In addition, producers now also earn the further amount captured by area 5. This additional profit does not come free, however. The cost of obtaining it is the cost of the advertising itself. Let us assume that the advertising cost is A dollars. The net welfare gain or loss for society will then be area $5 - A$.

One can immediately see that the above case suggests that firms with market power will advertise excessively. For the firm, the net profit gain from spending A on advertising is $1 + 2 + 4 + 5 - A$. For society though, the net gain is simply area $5 - A$. The former will often be positive even when the latter is negative and firms will advertise too much.

Do matters change if we instead base our surplus calculations on the demand curve D_1 , which reflects consumers' preferences after being exposed to advertising? The answer is, a little but not much. If we use the demand curve D_1 consumers still lose areas $1 + 2$ from their initial surplus. However, area 4 is no longer a loss as consumers now value these additional units at least as much as the price P_1 that they are paying for them. From consuming Q_1 units of the goods, consumers now gain additional surplus represented by areas $6 + 3$. The net change in consumer surplus is then area $3 + 6$ less area $1 + 2$. For the firm though the profit gain is the same, namely the sum of areas $1 + 2 + 4 + 5$.

Thus, using the post-advertising demand curve suggests that advertising may be less hurtful to consumers and more beneficial overall. Ultimately, however, it will still tend to be excessive. To see why, it is easiest if we assume advertising is subject to diminishing returns so that the same expenditure A pushes the demand curve out by smaller and smaller amounts. In the limit, few additional units are sold and areas 3, 4, and 5 become increasingly

small. The price effects, though, that permit a rise in the price consumer pays for the initial Q_0 units are first order effects. Even as consumers begin to cut back on their purchases, the firm can still gain area 1 in profit. Yet because this comes at consumers' expense, it does not represent a net social gain that would justify the additional advertising expense.¹³

Our analysis so far has not addressed the competitive impact of persuasive advertising. This is in fact not easy. Clearly, if one firm can use advertising to increase the demand for its product at the expense of a rival, the rival ought to be able to counteract that with advertising of its own. If advertising is truly uninformative and merely an effort in persuasion, this will yield excessive advertising at the industry if not the firm level as a "war of wasteful advertising" breaks out. The view of Bain (1956) and others, though, is that advertising competition is not typically this symmetric. In particular, incumbent firms may have the advantage of spreading the cost of advertising over an existing large volume of output relative to smaller new entrants. This will be especially true if advertising is not continuous but must be purchased in indivisible chunks. However, the competitive impact of advertising may be greatly altered if advertising conveys useful information.

19.4.2 Informative Advertising

There are many ways that advertising can provide useful information. It may for instance inform potential customers what the product does, as in medical products advertising or, relatedly, useful characteristics of the product, as in a digital camera's ability to interact with the Internet or an automobile's safety features. To the extent that such information enhances the demand for the product it works to shift in much the same way as the persuasive advertising illustrated in Figure 19.1.

Informative Advertising and Signaling

One difficulty with understanding advertising as an effort to provide consumers with information is that, as noted earlier, much advertising includes little or no information about the product. Yet even here it is possible that advertising nevertheless conveys useful information as two very influential articles by Nelson (1970, 1974) argue cogently.

Nelson (1970, 1974) began by raising the following question. "What do consumers *know* about a product *before* they purchase it?" More specifically, Nelson (1970, 1974) asked, "Can consumers identify the quality or other characteristics of the product before they try it?" For certain goods, specifically goods such as basic table salt or perhaps sunglasses, the answer is largely, "yes." There is very little variation in table salt and eyeglasses can be tried on and sampled before any purchase is made. These goods are examples of what are often called *search goods* in that the primary objective in shopping for them is to seek out where they are offered at the lowest price. However, Nelson argued that many for other goods,

¹³ Fisher and McGowan (1979) criticize the Dixit and Norman (1978) approach by arguing that the truly relevant comparison is one between the pre-advertising equilibrium using pre-advertising tastes and the post-advertising equilibrium using post-advertising tastes. This would mean that area 6 in Figure 19.1 would have to be included in the latter. Because this is not appropriated by the firm, its inclusion could easily yield the contrary result that the firm's advertising is below the socially optimal level. To some extent, however, this introduces the familiar problem of interpersonal comparison of utility levels. Note too that if there are strong scale economies, the increased output that advertising induces may lead to declining cost and price. This would complicate the welfare analysis further.

such as medications and personal computers, the answer was largely, “no.” These goods fall into a category that might be called *experience goods*, for which consumers cannot know the quality of the product—especially its quality in terms of the specific setting of a particular consumer—until after they have bought and used the product. However, the manufacturer of the product knows from the start whether it is a high-quality or low-quality product.

Nelson’s argument regarding the role of advertising in the case of experience goods is then quite straightforward. Once a consumer buys an experience good, the consumer will learn through use what sort of quality it is. To make matters a little more concrete, we will suppose that if it is a low-quality product, its value to the consumer is zero whereas if it is high-quality, its value is \$40. This quality is a random event based on the success of the product’s design with the probability being 80 percent that the design will work well. The actual production cost per unit is \$16 regardless of the kind of good being produced and the elasticity of demand is constant at $\varepsilon_D = 3$, regardless of the size of the market. As a result, we know from Chapter 4 that the firm’s optimal price is (from the Lerner Condition) $P^* = \$24$. Both the firm and consumers have a two-period horizon.

We will assume that the total demand for the product at the profit-maximizing price $P^* = \$24$ depends on the perceived quality of the good. If consumers know nothing more than the fact that there is a 20 percent chance of the product being low-quality, enough are sufficiently risk averse that only X consumers will purchase the product. However, if a product is known to be a high-quality good, demand rises by the proportionate amount α to $(1 + \alpha)X$. Finally, first-time sales only occur in the first period. The only buyers in the second period are those consumers who bought in the first period and, because of their experience, buy again in period 2 if the product is high-quality.

Note that regardless of whether the firm has a high-quality or low-quality product to offer, it will want to sell to as many first-period consumers as possible because it earns a profit of $\$24 - \$16 = \$8$ on every unit. Thus, regardless of its type, the firm would definitely like to claim that it is offering a high-quality product and expand first-period demand from X to $(1 + \alpha)X$. For this reason, just announcing that it is selling a high-quality good will not be enough to distinguish a high-quality firm from a low-quality one in the eyes of consumers.

However, there is one key difference between the two types of firms that may be exploitable. This is the fact that whatever customers it captures in period 1, a firm selling a high-quality good will gain all consumers back in the second period as repeat customers whereas one selling a low-quality product will not. For the moment, let us assume that if a firm adapts a first-period advertising program that costs $\$A$, consumers will regard it as selling a high-quality product. In that case, the firm making a high-quality product has the following choice. If it does not advertise, it will earn profits over the two periods with a present value V^H of:

$$V^H = \$8X + R\$8X = \$8(1 + R)X; \quad 0 < R < 1 \quad (19.7)$$

where R is the discount factor discussed in Chapter 2. Alternatively, the firm selling a high-quality good can spend $\$A$ on an advertising campaign and earn two-period profit with present value V_A^H :

$$V_A^H = \$8(1 + \alpha)X + \$8R((1 + \alpha)X) - A = \$8(1 + R)(1 + \alpha)X - \$A \quad (19.8)$$

Thus, if consumers view advertising as a signal of high quality, a high-quality firm will find it profitable to advertise if $V_A^H > V^H$, i.e., if $\$8(1 + R)\alpha X > \A or:

$$\frac{A}{8\alpha X} < 1 + R \quad (19.9)$$

Of course, if spending $\$A$ on an advertising campaign induces more first-period consumers to buy than a low-quality firm has some incentive to do this, too. If this turns out to be profitable, if both a low-quality and a high-quality firm gain from first-period advertising, then consumers cannot use the fact of advertising to indicate quality. Thus, we must make sure that this is not the case if advertising is to play a quality-signaling role in equilibrium.

Recall though that a low-quality firm will never make any second-period sales. Hence, it earns a profit of $\$8X$ if it does not advertise and a profit of $\$8(1 + \alpha)X - \A if it does. Therefore, a low-quality firm will not advertise if:

$$\frac{A}{8\alpha X} > 1 \quad (19.10)$$

Putting conditions (19.9) and (19.10), we have the following result. Consumers will be right to assume that a firm is selling a high-quality product if it is spending an amount $\$A$ on advertising that satisfies:

$$1 + R > \frac{A}{8\alpha X} > 1 \quad (19.11)$$

Because the discount factor R always exceeds 0, there will always be some value of A —some level of advertising spending—that a high-quality firm can profitably do that would not be profitable for a low-quality firm to imitate. That is, there will always be some value of A that separates a high-quality firm from a low-quality one and that, therefore, consumers can use the level of advertising as an accurate signal indicating they are buying a high-quality product. For instance, suppose that $X =$ one million, $\alpha = 0.25$, and the discount factor is $R = 0.9$ (corresponding to an interest rate of about 11 percent). Then an advertising budget of a little over $\$10$ million (but less than $\$19$ million) will do the trick.

The important point to note about Nelson's (1970, 1974) insight is that the advertising itself does not have to contain much information. It is simply the fact that the firm is spending $\$A$ on advertising that provides the signal. The underlying intuition behind this result should be clear. Advertising is an investment and the payoff to that investment depends critically on the number of repeat customers a firm obtains. It is precisely because high-quality firms win more repeat business that they can afford to make a more sizable advertising investment. In turn, it is precisely the fact that only high-quality firms can afford heavy advertising expenses that consumers can use that expense itself (and not the actual information content) as a signal of high quality.

Nelson's (1970, 1974) insight is important. Yet it is worth noting that Nelson's original work makes some important but not always explicit assumptions and its conclusion does not always survive changes in those assumptions. For example, the illustrative model above assumed that the price-cost margin was the same regardless of product quality, but this might not be the case as Schmalensee (1978) early demonstrated. For example, it may that a high-quality pain reliever can be produced at a cost of twenty cents per dosage while a worthless pain reliever costs only a penny per dose to make. Then a firm offering the

worthless painkiller may find that it can earn a very high markup on a very large volume even if no repeat purchases occur—enough to justify a heavy advertising campaign if that is what it takes to persuade first-time consumers that the product is high-quality. Again though, if low-quality firms find it worthwhile to advertise as much as high-quality ones do, then the signaling ability of advertising is lost.

Some further difficulties are also worth noting. Perhaps the most obvious of these is that if advertising expense really is an indicator of product quality, then we should observe firms simply announcing their advertising expenditures. That they do not suggests that the model has some important limitations. In addition, there is the fact that Nelson's (1970, 1974) model really applies best to so-called experience goods. Many well-known goods though such as a Ralph Lauren *Polo* shirt or a pair of Calvin Klein jeans can be tried on and inspected for fit, comfort, and appearance before purchase. Thus, they qualify more as search goods. Nevertheless, both firms advertise these products heavily contrary to what Nelson's (1970, 1974) analysis suggests.

Further, to the extent that Nelson's model applies to experience goods as a general category, it should apply to such goods regardless of the type of buyer. Yet in practice, advertising expenditure-to-sales ratios are markedly higher for experience goods that are marketed to consumers than for those that are marketed instead to other firms, i.e., intermediate or producer goods. Even within the consumer goods category advertising expenditures are also relatively high for search goods as well as experience goods.

Despite its limitations, the possible role for advertising as a quality signal is nevertheless a very important insight. Nelson's (1970, 1974) papers were among the first to raise this issue and, more generally, the problem firms face in trying to communicate credibly with consumers. As a result, this issue has generated much investigative research.¹⁴

Among the more important papers in this literature are those by Kihlstrom and Riordan (1984) and Milgrom and Roberts (1986). Kihlstrom and Riordan (1984) develop a two-period model in which a firm's advertising alone in the first period determines whether consumers believe the good to be a high- or low-quality product. Given consumer beliefs about quality, prices are then determined in a traditional demand and supply manner. The important result of the Kihlstrom and Riordan (1984) study is that they too find a strong incentive for high-quality producers to lure "repeat buyers" by advertising heavily in the first period, just as Nelson (1970 and 1974) found in his earlier analysis. The contribution of Milgrom and Roberts (1986) is to show that pricing can serve as a quality signal as well as advertising can. If both advertising and pricing can indicate quality though, the extent to which either is used is complicated. Using a high price to signal quality is a cheaper alternative for the firm than advertising, with the result that the Milgrom and Roberts (1986) paper weakens the theoretical link between advertising and product quality. The Milgrom and Roberts signaling model is, however, a monopoly or single firm model. Fluet and Garella (2001) show instead that when the firm competes in price with other firms it may be necessary to use advertising, and not price, to signal quality.

The large volume of papers on the signaling theory of advertising and prices has generated empirical research as well. In general, this research has tried to provide evidence on the extent to which the quality of a good is linked with the manufacturer's advertising-to-sales ratio, or price. Of course, one obvious issue is that the task of empirically measuring quality is far from easy. The truth is that quality has many dimensions and it is not clear how to combine the many dimensions into a single index. Nevertheless, broad rankings of product

¹⁴ See also Bagwell and Riordan (1991) and Schwartz and Wilde (1985).

quality are regularly published by Consumers Union. An important early study using this data was done by Reisz (1978) on over 10,000 brands of 685 products. He found, however, only a weak correlation between price and product quality.

If high prices do not necessarily signal high quality, what about advertising? Kotowitz and Mathewson (1986) examined this relationship for both automobiles and whole-life insurance. They did not, however, find evidence that the higher the advertising the better the deal. Similarly, Archibald, Haulman, and Moody (1983) examined running shoes and again found that neither price nor advertising levels for 187 brands were strongly correlated with the quality rankings, which were published in the magazine *Runner's World*. However, these authors did find that the magazine's quality ratings, once publicized and circulated, were very positively correlated with the extent of advertising done *after* those rankings were published. Firms with a high ranking were anxious to let consumers know this fact, while those with a low ranking were less interested in displaying their product's deficiencies.¹⁵

A study of 196 different industries by Caves and Green (1996) finds few discernible tendencies in the relationship between advertising and brand quality. For many industries, these authors find that the quality-advertising expenditure correlation approaches a negative one—the exact opposite of Nelson's prediction. They do, however, find a positive relationship between advertising and quality in the case of new or innovative goods. They also find a weaker but still positive correlation between advertising and the quality of those goods in their sample that might be called “experience goods.” The Caves and Green evidence on Nelson's hypothesis may then be best described as mixed.

Non-Informative Informative Advertising

As noted above, an attractive feature of the signaling view of advertising is that the advertising itself does not need to include any obvious or specific information. It is the fact of advertising itself that communicates product quality. This part of the theory definitely does find confirmation in the data. Much advertising seems to leave out important information such as price, quality of materials used, and so on. An alternative approach to the information content of advertising that offers a different explanation for this lack of advertising content has been offered by Anderson and Renault (2006). We explore their argument briefly, here.

The Anderson and Renault (2006) model starts by recognizing that once the consumer has traveled to a particular store, that travel cost is sunk. This can lead to a so-called “hold-up” problem for consumers. Recall the 1990s fad of Beanie Babies. Suppose that different consumers value the Beanie Babies differently. Some are willing to pay \$25 for *Crunch the Shark* whereas others do not value *Crunch* at all. Instead, they prefer *Chilly the Polar Bear*. If there are any transport costs, a retailer that advertises that it is selling *Crunch the Shark* will only attract the first group. Hence, the dealer may prefer to advertise that it has Beanie Babies in general and suppress the information that its inventory is *Crunch* in particular. The retailer knows—and consumers know that it knows—that anyone coming to the store and asking for *Crunch the Shark* values *Crunch* at \$25. Because the transport cost is sunk at that point, the retailer will have a strong incentive to “hold up” consumers and charge them the full \$25—ultimately deterring such buyers from responding to an ad.

Somewhat more formally, let there be three consumer types, 1, 2, and 3, and let us now just consider a relatively generic good called widgets that comes in three colors, red, blue,

¹⁵ Note that *Runner's World* allows manufacturers to quote their rankings in advertisements.

and yellow. Consumer type 1 values red widgets at \$40, yellow widgets at \$20, and blue widgets at \$15. Type 2 values red widgets at \$15, yellow widgets at \$40, and blue widgets at \$20. For type 3, the respective valuations are \$20, \$15, and \$40. The willingness to pay values for each consumer (which all consumers know) are shown in the Table 19.1 below.

We assume that each consumer also incurs a transport cost of \$5.01 to visit the store. Once a consumer actually visits a store, that transport cost is sunk. In the absence of knowledge of a store's actual stock, consumers rightfully believe that a store is equally likely to have either red, yellow, or blue widgets. Hence, if consumers know only that a store has widgets, they infer a probability of one-third that the store has widgets of any specific color. To keep things really simple, we also assume that the store incurs zero cost per widget.

Consider two advertising strategies for a store that has only red widgets. The store can advertise that it has red widgets or the store can advertise simply that it has widgets. Which strategy will the store prefer? First observe that the store will never set a widget price below \$15, the minimum valuation of any consumer. Now consider the first strategy of advertising that the store has only red widgets. If the retailer does this, consumer types 2 and 3 will not come to the store. The \$5.01 in transport cost will mean that the effective price for them will never be less than \$20.01. So, it is not worthwhile for either of these two types to come. Of course, the store knows this, too. So, if it advertises its "Red Widgets" alone, it knows that the only buyers who show up are type 1 consumers. Because, for these consumers, the \$5.01 in transport cost is a sunk cost once they are at the store, the owner can then charge them their full willingness-to-pay of \$40 for the widgets. Foreseeing this outcome, type 1 consumers will not respond to a red widget advertisement either. Advertising that the store only has red widgets will therefore not attract customers at all.

However, if the shop announces that it simply has widgets in general, consumers can reason as follows. Faced with a crowd of all consumer types but not knowing who is who, the shopkeeper will set a price of \$15 per widget. This will permit the store to sell one (red) widget to each type and earn a profit of \$45 from each threesome rather than set a price of \$40 and sell only to one type or a price of \$20 and sell to types 1 and 3 (each of which yields profit of \$40 per threesome). Moreover, because consumers infer that the probability associated with each color is one-third, all three types will in fact respond to the ad by showing up at the store knowing that when this happens, the store owner will keep the price at \$15. Consumer i will work out that for a price of \$15 and a transport cost of \$5.01, consumer i will receive either a red, yellow, or blue widget (each with probability 0.3333) whose value therefore is: $0.3333(\$40 + \$20 + \$15) = \25 , implying a net value of \$5 regardless of what consumer i 's most preferred type is.

There are a number of features of the foregoing outcome worth noting. First, the store suppresses some information in its advertising. Specifically, it does not reveal that its inventory is just red widgets. The store also does not need to mention the price in its ads. Consumers can work out that the profit-maximizing price to set is \$15. It is the presence

Table 19.1 Consumer type

| | | <i>Consumer 1</i> | <i>Consumer 2</i> | <i>Consumer 3</i> |
|-------------|--------|-------------------|-------------------|-------------------|
| Widget Type | Red | \$40 | \$15 | \$20 |
| | Yellow | \$20 | \$40 | \$15 |
| | Blue | \$15 | \$20 | \$40 |

of a variety of consumer types—due to precisely the vagueness of the advertisement—that supports this outcome. Because some of the consumers attracted to the store do not value red widgets very highly, the storeowner is motivated to keep the price low. We have a market outcome in which advertising deliberately does not mention either the specific attributes of the product for sale or its price.

Perhaps most surprising of all, the suppression of this informational content can raise welfare. To see this, observe that advertising red widgets led to a complete breakdown of the market whereas advertising widgets in general leads to trades from which everyone potentially can gain.¹⁶ In other words, a law requiring full disclosure by the retailer would make things worse.

Ellison and Ellison (2005) present a somewhat related argument regarding search engines on the web. In principle, search engines increase the competitive pressure on Internet firms. Moreover, the search engine can claim for itself some of the profit that would have gone to the firm in return for providing consumers with the relevant price information. Thus, an e-commerce company has some reason to thwart the search engine even though it may like the fact that the search engine or shopbot brings customers to its site. It can do this in a variety of ways. For example, it can list a low product price that the search engine sees but charge a very high transport price that the search engine does not see, or similarly offer only very slow delivery. Again, once the consumer has invested in the search cost and arrived at the firm's website, the firm may find that it can charge the consumer a very high price for the product that the consumer really wants, e.g., one with quick delivery. Here again, e-tailers are happy to list some information to entice the search engine but simultaneously to keep too much information from being revealed.

The point is then that advertising can play a useful role even when its information content is limited. In fact, it can do so even when firms deliberately suppress or obscure some of the information content. Such strategic choices enable firms to attract—and to serve—a wider range of customers than they would get if they offered complete information, and this may be necessary for the market to function at all.

Advertising, Information, and Price Competition

While much advertising may contain little concrete information, there is also no denying that a good bit of advertising *is* informative. Newspapers and magazines are filled with ads announcing sales, television commercials for cars typically mention explicit financing/lease terms and fuel mileage, airlines' and hotels' Internet spots mention availability and price, and this list does not even include the many informative advertisements in trade magazines. Moreover, even advertisements that do not include such explicit information serve the purpose of making the consumer aware of the product. As a result, advertising can be directly informative to consumers about the existence and features of alternative goods. Because it is difficult for a seller to sell a product at a high price when consumers are aware that a perfect or at least a good substitute may be available, truly informative advertising can be a highly useful and pro-consumer force that works to intensify market competition.

To see formally how advertising can intensify price competition we consider the Grossman and Shapiro (1984) reworking of the spatial Bertrand model of Chapter 10. Let there

¹⁶ Not counting (sunk) transport costs, all consumers and the seller are better off in the limited information equilibrium. Including sunk costs, type 2 consumers are (trivially) worse off but the gains for all other participants are enough that these consumers could be compensated while others would still be better off.

be two rival firms each located at either end of a unit long segment with a uniformly distributed population of N potential consumers. Each consumer will buy at most one unit of the good if their willingness to pay V exceeds the lowest price p_i plus transport cost t (per unit of distance) that they must pay to obtain it and if they know of that purchasing opportunity. Unlike that earlier model, however, we will assume that such knowledge is not complete. In particular, for each firm there is a fraction of the N consumers s_i who are only partially informed in that they know only of firm i 's product. There is also a fraction S_{ij} of fully informed consumers that knows of both products. Clearly, this latter fraction is the same for both firms, i.e., $S_{12} = S_{21}$. For simplicity, we will extend this symmetry to the fraction that knows only of one firm's product so that we also have: $s_1 = s_2$. In addition, we note the condition that $0 < s_i + S_{ij} \leq 1$, which implies also that $0 < s_j \leq 1$ and $0 < S_{ij} \leq 1$, as well as the fact that if $s_i(S_{ij}) = 1$, then $S_{ij}(s_i) = 0$. In other words, because the shares of either partially or fully informed consumers can never be negative, if one is unity the other must be zero. The $s_i N$ partially informed consumers and the $S_{ij} N$ fully informed consumers are also assumed to be uniformly distributed over the interval separating the two firms. Finally, each firm has a constant marginal cost c per unit.

We will assume that each consumer's willingness to pay V for the most preferred version of the good is reasonably high such that each firm has a captive demand of $s_i N$ from its partially informed consumer base. These consumers will buy from their preferred retailer even if it does not have the lowest (net-of-travel-cost) price. However, the firm also confronts a group of $S_{ij} N$ fully informed consumers who will only buy from the firm with the lowest price plus transport cost. We know from our work in Chapter 10 that for this group, the marginal consumer who is just indifferent between buying from either firm 1 or firm 2, has location (measuring from left (west) to right (east)) of $x^M = \frac{p_2 - p_1 + t}{2t}$. Hence, for firm 1 located at the left or western end of the segment, total demand is given by:

$$q_1 = s_1 N + S_{12} N \left(\frac{p_2 - p_1 + t}{2t} \right) \quad (19.12)$$

Hence, firm 1's inverse demand curve is given by:

$$p_1 = \left(\frac{s_1}{S_{12}} \right) 2t + p_2 + t - \left(\frac{2t}{S_{12} N} \right) q_1 \quad (19.13)$$

It follows that firm 1's marginal revenue curve is:

$$MR_1 = \left(\frac{s_1}{S_{12}} \right) 2t + p_2 + t - \left(\frac{4t}{S_{12} N} \right) q_1 \quad (19.14)$$

Equating MR_1 with the firm 1's marginal cost c and solving for firm 1's optimal output conditional on p_2 yields:

$$q_1^* = \left(\frac{s_1}{2} \right) N + \left(\frac{S_{12}}{4t} \right) N(p_2 + t - c) \quad (19.15)$$

Substituting the above result into equation (19.13) then yields firm 1's best response function to any price p_2 set by its rival:

$$p_1^* = \frac{c}{2} + \left[\left(\frac{s_1}{S_{12}} \right) + \left(\frac{1}{2} \right) \right] t + \frac{p_2}{2} \quad (19.16)$$

Hence, our symmetry assumption that $p_1^* = p_2^*$ implies that the equilibrium price p for both goods will be:

$$p = c + \left(\frac{2s_1 + S_{12}}{S_{12}} \right) t \quad (19.17)$$

It is easy to verify that when the entire market is fully informed so that $S_{12} = 1$ and $s_1 = s_2 = 0$, equation (19.17) implies an equilibrium price of $p = c + t$, exactly as found in Chapter 10. It is equally easy to see that as S_{12} falls below this value, the equilibrium price rises.¹⁷ The underlying intuition is also straightforward. Firms compete for the fully informed consumers but charge the same mill price to all. As more consumers become fully informed, each firm has a greater incentive to lower its price a bit and win more of this larger market share. Hence, the greater the proportion of potential consumers who know of both products and can therefore do comparison shopping, the more intense the price competition grows.

Advertising is of course a way for firms to inform consumers of their products. Indeed, each firm must advertise if it is to reach any consumers at all. Therein lies the rub. Each firm needs to advertise if any consumers are to be informed either partially or fully. Yet neither firm can be sure that its advertisements will simply reach those consumers who are unaware of the rival's products. To the contrary, the greater the effort each makes to reach some consumers, the more likely it becomes that an important segment of the market is aware of both goods and it is competition over that segment that drives the equilibrium price progressively lower.

In the Appendix, we present a simple version of the foregoing model in which firms choose their advertising effort as reflected in the fraction of consumers they try to reach as well as select their profit-maximizing price. The general point should be clear, though. To the extent that advertising does provide consumers with information about alternative products, it tends to intensify price competition to the benefit of the consumer. Note, however, that this does not mean that the market becomes more competitively structured or that more firms enter the market. Quite to the contrary, the intensified price competition that advertising induces can easily serve to limit entry and to foster a more concentrated industry.

While we noted the potentially negative anti-competitive effects that early researchers such as Bain (1956) found, the fact is that there is much empirical evidence to support the view that advertising prices and retail locations intensifies price competition. Early on, Telser (1964) showed that greater advertising intensity was associated with more volatility in market shares, leading him to conclude that advertising promoted competition. More explicitly, Benham (1972) showed that the average price of eyeglasses was significantly

¹⁷ If S_{12} gets very small, the price is limited by consumers' maximum willingness to pay V . The Grossman-Shapiro (1984) is just one model of advertising and consumer search. Others include: Stigler (1968), Butters (1977), and Clark and Horstmann (2005).

higher in states where advertising the prices and retail locations of opticians' services was prohibited. Similar price effects when advertising is restricted were found by Cady (1976) in the market for prescription drugs. [See Milyo and Waldfogel (1995) for related evidence from the retail liquor industry.]

Glazer's (1981) study of the New York City newspaper strike provides three connected but chronologically distinct bits of the pro-competitive role of advertising. That strike, which ran for nearly three months starting in August, 1978 shut down each of the three major New York City newspapers, *The New York Times*, *The New York Post*, and *The Daily News*, and thereby greatly reduced the access that city residents had to any advertising of supermarket food prices. However, within a few weeks of the strike's beginning, a number of interim papers emerged that potentially filled this informative role, although

Reality Checkpoint

Everyday Lowe's Prices

Lowe's is the second biggest home improvement retailer in North America and one of the country's fifty largest firms with annual revenues of nearly \$50 billion. Even so, it lags well beyond its main rival, Home Depot, whose revenues are roughly twice as large. Home Depot has traditionally been seen as having consistently lower prices and better services.

These competitive pressures have prompted Lowe's to move away from a strategy of typically setting high prices but periodically holding sales with steep discounts to an Everyday Low Pricing (EDLP) strategy that sets a low price continuously. The EDLP approach was pioneered by Wal-Mart and offers a number of advantages in that it enables retailers to reduce inventory costs, better coordinate supply chains, and reduce the risk of stock shortages by smoothing the demand variability induced by frequent sales. On the other hand, the former high-low pricing strategy permits the revenue gains of price discrimination. In addition, holding sales on specific items from time to time attracts consumers to a store where they may see—and purchase—items that are not on sale.

To improve service, Lowe's introduced a web-based tool called My Lowe's. This permits individuals to set up individualized

histories of what they have previously bought at Lowe's. In turn, this makes it easier for replacements and repairs to match original models, and permits customers to upload photographs and then use computer visualization techniques to see the effects of different colors, materials, and designs on the final outcome of a home improvement project. Ultimately, the My Lowe's site became accessible via a mobile app, as well.

To get the word out about its pricing and new service, Lowe's launched an expensive new advertising campaign, "Never Stop Improving," stressing the need for continued home modifications over a typical family's lifespan and encouraging consumers to establish the My Lowe's profiles. This suggests that aggressive advertising is complementary to low prices, and that both reflect a move towards more intense competition. Such increased competitive intensity may have been the result of the steep drop in construction activity and therefore the drop in demand for home improvement projects in the wake of the deep recession that began in late 2007.

Source: Associated Press, "Lowe's Says Price Cuts Helped Lift Its Profit," *New York Times*, February 26, 2013 p. C4.

their circulation was much smaller. These events make for a natural comparison with nearby Nassau County on Long Island, which suffered no real break in the publication of its local newspapers. Glazer (1981) therefore compares the food prices in Queens (one of the New York's five boroughs) with those in neighboring Nassau county over each of three periods: 1) the early part of the strike when Queens residents had little food price information; 2) the latter part of the strike when Queens residents had some information from interim papers; and 3) the post-strike period when Queens residents were once again presumably as well informed about local food prices as were residents in neighboring Nassau. The basic results were that food prices rose about 3.4 percent *more* in Queens during the first period; rose no further during the second period; and then rose 8 percent *less* than Nassau prices in the last period. In other words, the basic pattern was that Queens' food prices became more competitively priced relative to Nassau prices the more advertising information Queens residents had.

More recently, two closely related papers by Slade (1995) and Pinkse and Slade (2007) analyze the joint advertising and pricing decisions of rival supermarket firms. Focusing on saltine crackers, Slade (1995) finds that each supermarket tends to advertise more when its rivals raise their price and, conversely, that each tends to cut its price in response to a rise in rivals' advertising. Both effects suggest that advertising fosters price competition. Working with the same data, Pinkse and Slade (2007) find that the advertising effort is complementary to price reductions, i.e., firms advertise more heavily to spread the word about a recent reduction in price. This too suggests a pro-competitive effect for advertising although the longer-run dynamics are more complicated as rivals respond to these strategic choices. Relatedly, Nevo (2001) shows that advertising plays a key competitive role in the ready-to-eat breakfast cereal market.

19.5 ADVERTISING: COMPLEMENTS, COORDINATION, AND INDUSTRY DYNAMICS

In this section we offer some further considerations regarding how advertising works and its impact on industry outcomes. One possibility—raised early by Stigler and Becker (1977) but presented more formally by Becker and Murphy (1993)—is that advertising works because consumers value it as a complement to the advertised good. An analogy that Becker and Murphy (1993) use is that advertising is much like the television or newspaper coverage of a local sports team. The report of a game's outcome and recap of the key events may neither change consumers' tastes, as in the persuasive view, nor add useful information (especially to those who were at the game), as in the informative view. Nevertheless, such coverage raises consumer interest in and demand for attending team games.

In the Becker and Murphy (1993) view, advertising can work in this same complementary way to raise the demand for the advertised good. Of course, informative advertising can act as a complement as well. The value of the Becker and Murphy (1993) approach is that this conceptualization makes it easy—at least in theory—to work out whether or not advertising is excessive without any need to worry about whether to use pre- or post-advertising demand curves. The question boils down to whether the extra value that advertising brings to consumers plus the extra profit it brings to producers (all at the margin) covers the advertising marginal cost. In this respect, it is entirely possible that advertising may work to raise the elasticity of the firm's demand. If so, then as the total amount of the advertised

good that is sold rises, the price must fall because $(p-c)/p = 1/\varepsilon_p$ is a necessary condition for profit maximization. In turn, Becker and Murphy show that this implies there will be *too little* advertising as it means that the advertiser will not take the greater product value that consumers get from the product into account in deciding how much advertising to do.

Pastine and Pastine (2002) offer a different role for advertising in markets where each consumer wants to purchase the same brand as most other consumers. In such markets, there are network effects (see Chapter 22) that reflect an externality on the demand side—the more people that buy a specific brand, the more valuable that brand is to each consumer. Network markets are typically characterized by multiple equilibria and some equilibria—often those in which all or virtually all consumers purchase the same brand—raise welfare higher than other equilibria. In their model then advertising plays a useful, welfare-enhancing role even though it does not change consumer tastes, provide information, or serve as a complement to the good itself. Instead, advertising is helpful because it can serve as a device for coordinating consumer purchasing decisions. With each consumer forming the expectation that the brand other consumers will buy will be the one that is most heavily advertised, that expectation can become self-fulfilling and therefore rational. On the supplier side, Pastine and Pastine (2002) assume a duopoly model in which each firm chooses its advertising level for two periods with one firm choosing in period t and the rival choosing in period $t + 1$. This means that in any specific period, one firm's advertising is pre-set while the rival gets to re-set its choice from two periods earlier. The firm that is free to choose its advertising in any period then has an incentive to out-advertise its rival precisely because consumers are using that advertising to coordinate their decisions—thereby reinforcing the self-fulfilling expectational equilibrium. This leads to interesting dynamics over time as an advertising war breaks out in which each firm increases its advertising every two periods until a maximum is reached. At that point it becomes worthwhile to reduce the advertising effort back to a low level from which the process can start all over again. The model also helps to explain why much advertising is directed at young people for whom peer pressure and “being in” may be most important.

Finally, a recent article by Dinlersoz and Yorukoglu (2012) builds on the point made at the beginning of this chapter that breakthroughs in information technology and the ability to reach consumers with advertising can have a dramatic effect on the evolution of an industry. In their model, firms advertise prices and more efficient firms can advertise lower prices. As a result, more efficient firms grow in size and less efficient firms shrink and exit. (Firm growth is therefore *not* independent of firm size in contrast to the assumption of the Gibrat process discussed in Chapter 12.) Because consumers tend to repurchase from firms from which they recently bought, relatively more efficient firms will also tend to win more repeat sales and therefore become relatively larger firms over time. Hence, their model predicts a positive relation between a firm's advertising effort and its size as noted earlier in this chapter. More importantly, when there is a decline in the cost of advertising, e.g., the information revolution reflected in the rapid extension of the Internet, information dissemination will accelerate to the benefit of the most efficient firms with the result that concentration will increase even as price competition intensifies. Dinlersoz and Yorukoglu (2012) present evidence that this is exactly what has happened in industries with significant web-based sales, such as bookstores, camera and photo stores, and travel agents. Apart from providing a rich description of market evolution, the Dinlersoz and Yorukoglu (2012)

study serves again to remind us that market structure is endogenous and not necessarily a good proxy for the intensity of price competition.¹⁸

19.6 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 paper by Daniel Akerberg (2001), though, does offer some interesting and promising results.

Akerberg's (2001) paper studies the introduction of a new yogurt product by Yoplait, the second largest yogurt firm in the United States. 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. That data included scanner readings used to monitor the shopping trips and purchases of these households. It also included recordings from TV meters installed in the consumers' homes that allowed Nielsen to monitor their television viewing and, hence, their exposure to *Yoplait 150* advertising over the twelve 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.

Akerberg (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 models suggest that the role of advertising is not informative but instead one that confers a separate recognition or prestige effect of its own. Akerberg (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 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,

¹⁸ Bagwell and Ramey (1994) derive a similar outcome when the demand-raising effects of advertising permit scale economies and so lower prices even as concentration rises. All these studies on advertising and industry dynamics recall the critical work of Sutton (1991).

but one that should definitely diminish as they become more experienced with the product. However, if advertising confers a 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 it for the first time or the tenth.

Akerberg (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. Akerberg (2001) then creates separate time series of first-time sales and repeat sales on specific market days over the twelve-month period. For each of those making either a first or a repeat purchase, Akerberg (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). Because *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 19.2 below:

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 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, Akerberg (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 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_{jit} and a random factor ε_{it} . That is

$$y_{it}^* = \sum_{j=1}^k \beta_j X_{jit} + \varepsilon_{it} \quad (19.18)$$

Table 19.2 Preliminary results

| Independent Variables | Dependent Variable | | | |
|-----------------------|--------------------|------------|------------------|------------|
| | Initial Purchases | | Repeat Purchases | |
| | Coefficient | Std. Error | Coefficient | Std. Error |
| PRICE | -0.038 | (0.013)* | -0.029 | (0.014)* |
| ADS | 0.030 | (0.015)* | 0.014 | (0.017) |
| MARKET | 0.002 | (0.001)* | 0.006 | (0.001)* |

*Indicates significant at the 5 percent level.