The Targeting of Advertising

Ganesh Iyer
Haas School of Business, University of California, Berkeley, Berkeley, California 94720-1900,
giyer@haas.berkeley.edu

David Soberman
INSEAD, Boulevard de Constance, Fontainebleau, France 77305, david.soberman@insead.edu

J. Miguel Villas-Boas
Haas School of Business, University of California, Berkeley, Berkeley, California 94720-1900,
villas@haas.berkeley.edu

An important question that firms face in advertising is developing effective media strategy. Major improvements in the quality of consumer information and the growth of targeted media vehicles allow firms to precisely target advertising to consumer segments within a market. This paper examines advertising strategy when competing firms can target advertising to different groups of consumers within a market. With targeted advertising, we find that firms advertise more to consumers who have a strong preference for their product than to comparison shoppers who can be attracted to the competition. Advertising less to comparison shoppers can be seen as a way for firms to endogenously increase differentiation in the market. In addition, targeting allows the firm to eliminate "wasted" advertising to consumers whose preferences do not match a product's attributes. As a result, the targeting of advertising increases equilibrium profits. The model demonstrates how advertising strategies are affected by firms being able to target pricing. Target advertising leads to higher profits, regardless of whether or not the firms have the ability to set targeted prices, and the targeting of advertising can be more valuable for firms in a competitive environment than the ability to target pricing.

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1. Introduction

Advertising is one of the most important decisions a marketer makes, and media purchasing is the largest element of advertising spending. Ensuring that media is bought effectively and not directed toward the "wrong people" has always been a challenge for marketers.[1] Traditionally, the objective in media planning was to minimize wasted advertising by reducing the quantity of advertising sent to consumers who are not active in the category. However, firms can now do much better than reduce advertising to nonusers. They have both the know-how and the means to target advertising to segments of consumers within a market. This ability comes from two key changes in the marketing environment. Today, firms have much better information on consumers, their preferences, and their media habits (see "Star Turn," *The Economist*, March 9, 2000). This is the result of significant improvements in the ability to collect and process consumer-level information. The second change

is the fragmentation of existing media (broadcast TV, for example) and a multitude of new advertising media (the Internet, satellite shopping channels, and infomercials). Sophisticated media buying now provides firms with the ability to target specific segments within a market (see "Infinite Variety," *The Economist*, November 19, 1998). Because firms need to ensure that marketing spending has impact, it is not surprising that they are increasingly active in the use of targeted advertising.

In media planning, firm objectives are often to target advertising to specific consumer groups. For example, consider the U.S. light beer market in which Miller Lite and Coors Light are major competitors. The light beer market is comprised of distinct demographic groups that vary in their consumption profile. Miller Lite, the "diet beer," has traditionally been directed to mature male beer drinkers in their mid- to late 30s who are concerned about their waistline. In contrast, Coors Light has been more popular among young and relatively new beer drinkers (men and women in their early 20s). But a substantial proportion of light beer consumption resides in the intermediate segment comprised of

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[1] This is a classic concern and goes back to at least John Wanamaker's (a 19th-century department store owner) comment "Half the money I spend on advertising is wasted and the trouble is I don't know which half."

young adults in their late 20s to early 30s. These consumers are more uncommitted in their brand preference and are indifferent between the two brands.[2] An important question for firms is the decision about how to allocate media budgets between segments where they have a strong franchise and segments of uncommitted consumers who choose between competing brands. On the one hand, it can be argued that concentrating advertising on consumers who are strongly predisposed to buy a firm's product should be advantageous (for Miller, this would mean targeting advertising effort on mature male beer drinkers), given that these consumers are more disposed to buy and are willing to pay higher prices. On the other hand, competition is highest for consumers who do not have a strong preference for one of the competing products (in the light beer example, this would be the intermediate segment). Without a strong advertising effort, these consumers may be lost to the competition. Will the attractiveness of an intermediate segment with weak preferences lead to aggressive advertising by both firms or will firms limit competition for these consumers with lower advertising? We consider this question with a model of a differentiated market with two competitive firms, each of which sell a single product. We examine how the ability to target advertising to specific segments affects advertising and pricing decisions.

The following questions are analyzed in this paper. When firms have the ability to choose different levels (media weights) of advertising to different consumer segments, how will they choose media weights? Should a firm advertise more to consumers who have a strong preference for its product or to consumers who are more likely to comparison shop amongst alternatives? How are equilibrium pricing and profits in a market affected by the firms' ability to target their advertising? We also examine how the ability to target advertising affects the level of advertising spending by firms. Recent advances in consumer information and database technologies also mean that firms can price discriminate and offer different prices to different groups of consumers. We then ask how the ability to target advertising interacts with targeted pricing.

We consider a model where a firm's advertising provides complete information about its products to potential consumers, but advertising may be too costly for all competitors to always advertise. Each

firm has a group of consumers who have a strong preference for its product, i.e., they only consider buying from that firm (up to a reservation price). There is also a group of consumers who compare the prices at both firms and buy at the lowest price. Advertising is costly and the cost of informing a group of consumers is directly proportional to its size. The targeting of advertising implies that firms can design media vehicles to target advertising messages to specific segments in the market. A firm that cannot target advertising advertises uniformly to the entire market.

We show that when firms have the ability to target advertising, each firm advertises more to the segment that has a strong preference for its product than to the segment of consumers who comparison shop. When comparison shoppers are informed about both products, they perceive no differentiation between them and this leads to intense price competition. Firms respond by reducing advertising to comparison shoppers. Consequently, there are times when comparison shoppers are informed about only one firm's product. In this situation, that firm has monopoly power over the comparison shopper segment. Indirectly, this reduces the intensity of price competition. Thus, advertising less to comparison shoppers is an indirect way of creating market differentiation. The targeting of advertising also provides a direct benefit of eliminating "wasted" advertising to consumers who prefer to buy the competing product. For these reasons, the ability to target advertising increases the equilibrium profits of firms.

When firms move from a strategy of uniform advertising to targeted advertising, the total amount spent on advertising can either increase or decrease. When advertising is expensive, the inability to target advertising leads firms to choose low levels of advertising. While this means less wasted advertising, firms are also not able to realize the demand potential in the market because few consumers are informed. In this case, targeting helps firms realize higher demand and firms increase their advertising expenditures. In contrast, when advertising is inexpensive, then a firm chooses high advertising levels with uniform advertising. This implies that the extent of wastage is significant and the ability to target advertising leads to lower advertising expenditures.

We also analyze how targeted advertising interacts with targeted pricing. Our analysis shows that in a competitive environment, the ability to target advertising is more important for profits than the ability to target pricing. When firms have the ability to choose different advertising levels for different groups of consumers, it leads to higher profits independent of whether or not firms have the ability to set targeted prices. In contrast, the ability to target prices creates

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[2] See the discussion "Competition: A Whole New Ball Game in Beer," *Fortune*, September 19, 1994, p. 79, and Lee, Thomas, "Miller's Time May Be Running Out: Brewer's Sales Remain Flat Amid Talk That Philip Morris Will Sell to Foreign Firm," *St. Louis Post-Dispatch*, March 10, 2002, p. E1. Roy (2000) could potentially be seen as a justification for why the high preference segments for Miller Lite and Coors Light are different. This difference could also be seen as just a basic product differentiation decision.

increased competition for comparison shoppers and no improvement in equilibrium profits.

We examine the market outcomes when firms invest to obtain the ability to target advertising. Given the increased profits associated with targeting advertising, both firms will acquire targeting capability if the fixed cost to obtain it is sufficiently low. Similarly, both firms choose not to target advertising when the fixed cost is very high. But interestingly, when the cost of targeting is in an intermediate range, asymmetric firms arise endogenously. While one firm invests to obtain targeting capability, the other chooses not to invest. Differences in the ability to target advertising are also a way to reduce competition for comparison shoppers. Finally, we examine the case of imperfect targeting in which advertising by a firm to a specific segment leaks to other segments and shows that leakage leads to lower equilibrium firm profits.

Several papers have looked at the impact of advertising on product information and pricing. In particular, Butters (1977) proposes a message-sending model, where advertising provides information about the existence of products (and their characteristics) and the higher the level of advertising a firm chooses, the more likely a representative consumer is exposed to it. Grossman and Shapiro (1984), Stahl (1994), and Soberman (2004) extend this model to markets with horizontal differentiation and analyze the impact of informative advertising on market competition and the provision of variety. All of these papers assume that advertising is uniform throughout the market.[3]

Esteban et al. (2001) allow different levels of advertising to be directed at different segments (or locations) within the market. That paper considers a monopolistic firm that faces a market where customers have heterogeneous reservation prices, and argues that the monopolist will direct heavier advertising weights to the consumers who are willing to pay more for the product, and that the overall level of advertising falls with targeting. Roy (2000) considers the competition for a homogeneous good where firms can target consumers, and compete on prices after observing the competitor's advertising. In contrast, this paper considers a differentiated market (that reduces to a homogeneous good if $h = 0$, as described later) where firms can target consumers according to their preferences and set prices without knowing the competitor's advertising.[4] In addition to characterizing the targeting equilibrium, we consider the question in both uniform pricing and targeted pricing contexts. Roy (2000) assumes that consumers have unique addresses (which are unrelated to consumer preferences because consumers have homogenous preferences) and argues that firms choose to advertise to different individual consumers. This idea might be seen as related to the result in this paper that firms advertise less to the comparison shopper segment than to the segment of consumers who have a high preference for the firm. However, the result in Roy (2000) depends on the assumptions that pricing decisions are made after observing the competitor's advertising and that firms are able to target advertising to individual consumers. In addition, Roy's (2000) model generates an infinite number of equilibria, all of which depend on significant coordination between firms (firms target consumers with no overlap). Stegeman (1991) considers the welfare implications of informative advertising in a model with a large number of competitors selling a homogeneous good. Consumers may have different valuations for the good and firms can target advertising to consumers with different valuations. However, because the model pertains to a homogeneous good, there is no possibility of consumers having different preferences for the competing products in the market.

In this literature, targeted marketing activity has been analyzed in context of other marketing elements. Price discrimination based on customer recognition has been examined by Villas-Boas (1999, 2004) and Fudenberg and Tirole (2000). Previous research has also examined location-specific pricing (Thisse and Vives 1988, Shaffer and Zhang 1995), the role of imperfect customer addressability (Chen and Iyer

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[3] Rajiv et al. (2002) model price promotional advertising strategies when firms are asymmetric along a quality dimension. Villas-Boas (1993) considers dynamic competitive effects with advertising pulsing (see also Villas-Boas 1992 for other applications of the same framework and Dubé et al. 2004 for an empirical analysis). Vakratsas et al. (2004) investigates the shape of the advertising response functions that could justify pulsing. Consumers can also potentially find information about existing product attributes, including price, through search (Kuksov 2004) and through the use of comparative shopping mechanisms (Iyer and Pazgal 2003). Bass et al. (2004) consider dynamic competition with both generic and brand advertising. Shaffer and Zettelmeyer (2004) consider advertising in a distribution channel. Baye and Morgan (2004) consider the effect of uniform advertising on the creation of brand awareness and price competition in online markets.

[4] Several of the main results also generalize to the symmetric equilibrium in the case in which firms set prices after observing the competitor's advertising, given that in such an equilibrium, the advertising strategy is in mixed strategies. Analyzing the case in which firms set prices after observing the competitor's advertising may perhaps be more appropriate for the case of large visible advertising campaigns, where a firm can better infer the competitor's advertising spending ex ante before the pricing decision. However, it is typical in many cases for firms to not have good knowledge of their competitor's advertising plan or budgets. Indeed, firms are cautious about not letting their competitors learn about their advertising plans. The case of pricing without observing the competitor's advertising is also relevant for the case of less visible or more targeted advertising or direct mailings. Butters (1977), Grossman and Shapiro (1984), and Stahl (1994) consider pricing without observing the competitor's advertising.

2002), the imperfect targeting of prices to customers (Chen et al. 2001), and the impact of targeted product modifications (Iyer and Soberman 2000). Some of the nature of the effects in this literature is discussed in §3.3. This paper contributes to this research by analyzing the impact of targeted advertising in a competitive setting. The rest of this paper runs as follows. Section 2 describes the basic model. In §3, we present the main results of this paper and some anecdotal information from retail markets to support the analysis. Finally, §4 presents concluding remarks.

2. The Model

We develop a model of a market with two firms, $i = 1, 2$. Each firm produces its product at a constant marginal cost of production, which is assumed to be zero without loss of generality.[5] We start by describing the consumer market. The market is comprised of a unit mass of consumers. Each consumer has a demand of at most one unit of the product. Consumers have a common reservation price r for the product. Assume that each firm has a segment of consumers who have high preference for its product in the sense that they consider buying only from that firm as long as the price at the firm is below the reservation price r. The proportion of these consumers per firm is given by h. The remaining consumers are comparison shoppers who are indifferent between the firms and prefer to buy the product with the lowest price (as long as this price is below the reservation price). The size of this segment s is given by $s = 1 - 2h$. The role of this segment is to represent consumers who have less intense preference for either brand. Note that h represents the extent of ex ante market differentiation, with higher values representing greater differentiation between the firms, because more consumers would have different preferences across firms. When $h = 0$, all consumers comparison shop between the two firms and the competition between the firms reduces to Bertrand price competition.

Consumers are endowed with preferences over product attributes, but without advertising, do not know which products exist or their characteristics (they do not search for information about products). The role of advertising about a product is to convey information that the product exists and its product attributes (which might also include the price), so that an originally uninformed consumer can evaluate its degree of preference for the product and decide whether to buy it or not. Advertising directed

toward these consumers provides them with information on the product and its characteristics. For example: Does the product possess the attributes that the consumer requires to consider it for purchase? Of course, this simply implies that advertising facilitates consideration of the product by the consumer. If the product does not fit a consumer's needs or if the price is too high, she will not buy. Note that we are assuming that advertising is necessary for the consumer to be in the market and to consider the product. Later in §3.5, we extend the model to consider the case in which some proportion of the consumers are informed and would consider buying the product even without receiving advertising.

The characterization of advertising is consistent with behavioral research that documents how advertising makes a product and its characteristics salient in the consumers' memory. This, in turn, enhances the likelihood that consumers consider the product if its characteristics do indeed match consumer tastes (see Mitra and Lynch 1995).[6] For new products, awareness is clearly the first stage in creating demand for a product. Consumers also use advertising for new products to obtain information about key product features. The formulation is also consistent with the role advertising plays in mature product categories. Keeping a product "top of mind" and priming the consumer to consider it is critical in established categories such as beer and soft drinks. For example, in the soft drinks market, one might argue that the product features of Coke and Pepsi are known to most consumers. Yet, these brands spend a significant amount of their budget on reminder advertising aimed at keeping the brand top of mind. In our model, this simply means that advertising increases the consideration of the product by consumers. Advertising could also have other roles not considered here such as changing the consumer valuation for products, possibly in different ways across consumer types.

We assume that the cost to advertise to the entire market is A. When advertising can be targeted to particular segments in the market, we assume that the cost to advertise to each segment is linearly related to its size.[7] Therefore, if a firm is able to target advertising, the costs are Ah for the high preference consumer

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[5] The model and results can be extended to a market with N firms, where each firm has demand from a high preference segment and a comparison shopping segment that is common, along the same lines as in Varian (1980).

[6] Anand and Shachar (2001) also show this effect with actual data. Furthermore, advertising can be seen as creating heterogeneity in the set of products that consumers consider depending upon the number of firms from whom the consumers receive advertising. As shown in Mehta et al. (2003), there can be substantial heterogeneity in the consideration sets of consumers in a market.

[7] Some research has discussed the possibility of the response to advertising being *S*-shaped or nonlinear. See, for example, Thompson and Teng (1984), Eastlack and Rao (1986), Mahajan and Muller (1986), Rao (1986), Sasieni (1989). The advertising technology in the model and its results can be both consistent with the case of extreme *S*-shape and with the case of linear costs.

segment and As for the comparison shopping segment. There is some discussion that targeted media vehicles are more costly on a per consumer basis (Esteban et al. 2001). Incorporating this effect into the model would just make the targeting of advertising less profitable without affecting the main messages of this paper. This paper considers the fixed costs of obtaining targeting capability in §3.4. Note that a firm does not have an incentive to target advertising to the h segment of its competitor since those consumers will not buy its product. We consider advertising that informs all of a given segment or none of it.[8]

3. Equilibrium Analysis of Advertising and Price Competition

We start the analysis with the case when firms do not have the ability to target advertising or pricing to specific segments of the market. It provides a base case that we use to interpret the impact of targeting.

3.1. Uniform Advertising and Price Competition

Consider that in equilibrium the firms advertise. With uniform advertising, firms can reach the entire market for a cost A. The price equilibrium will then be in mixed strategies. The reasoning is as follows: Suppose that one firm; say, Firm 2, chooses a price p_2 that is not too low; then Firm 1 can undercut p_2 to attract all the comparison shoppers (these consumers make a comparison and will choose Firm 1 because its p_1 is slightly lower). Otherwise, Firm 1 will set prices at the reservation price to maximize the profit from its informed h consumers. In either possibility, Firm 2's best response is then not to charge p_2, and we end up with a price mixed strategy equilibrium (Varian 1980).

Denote the c.d.f. (cumulative distribution function) of the mixed strategy price distribution without advertising to be $F_i(p)$. In a symmetric equilibrium $(F_i(p) = F(p))$, the profit of a firm when charging a price p in the mixed strategy profile will be given by $\pi(p) = hp + sp[1 - F(p)] - A$. Using standard analysis (e.g., Varian 1980, Narasimhan 1988, Baye et al. 1992), the equilibrium profit is the guaranteed profit that a firm can realize by charging the reservation price and selling only to its h segment, $\pi(r) = hr - A$.[9] If it is greater than the profit associated with not advertising, i.e., zero, then firms always advertise in equilibrium. Equilibrium advertising is thus characterized by Lemma 1.

LEMMA 1. *When $hr > A$, firms advertise in equilibrium with probability one. When $hr \leq A$, then the equilibrium will involve firms using mixed advertising strategies.*

Firms always advertise if the guaranteed profits from the high preference segment are large enough to cover the cost of advertising. This happens when the extent of differentiation (h) or the reservation price are sufficiently high. For the case in which firms advertise with probability one, simple calculations will verify that $\partial F(p)/\partial h < 0$. Thus, the average price charged by a firm increases with the extent of differentiation between the firms (i.e., a larger h).

The interesting case is when firms do not find it optimal to advertise with probability one. In other words, in less differentiated markets, if the reservation price for the product is small compared to the cost of advertising, firms use mixed strategies in advertising. To focus on some basic effects of advertising, our model assumes that each period is independent and that there are no carry-over effects for consumers.[10] We can interpret the probability with which firms advertise as the intensity of advertising within a planning period. Basically, through its advertising frequency, a firm determines the likelihood that a consumer becomes informed (or aware of the product) during the period. The more intense the advertising is, the higher the likelihood that the consumers become informed.

For this case, there is a unique symmetric equilibrium. To derive the equilibrium when firms employ mixed strategies in advertising, define α as the probability of advertising by a firm. From the property of a mixed strategy equilibrium, the profits between advertising and not advertising are equal, which implies the following equilibrium condition, $hp + (1 - \alpha)sp + \alpha sp(1 - F(p)) - A = 0$. From this, if $A > r(1 - h)$, then the firms will not advertise; i.e., advertising is not feasible. When $A \epsilon(rh, r(1 - h))$, advertising strategies are mixed: advertising costs are low enough such that advertising is efficient (with probability less than one), but not so low that firms choose to advertise with probability one. The equilibrium solution leads to Proposition 1.

PROPOSITION 1. *When $hr \leq A$, and with uniform advertising, the equilibrium profits are zero and the equilibrium probability with which firms advertise is $\alpha^* = 1 - (A - hr)/sr$. In addition, firms employ mixed pricing strategies with c.d.f.*

$$F^*(p) = 1 - \frac{r - p}{p}\left[\frac{A}{(1 - h)r - A}\right] \quad \text{for } p \in \left[\frac{A}{1 - h}, r\right].$$

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[8] Iyer et al. (2002) extends the model to a continuous representation of advertising with costs that are convex in the proportion of consumers reached within a segment, and shows that the results are similar when firms can advertise to any proportion of a segment.

[9] See Zhao (2004) for a descriptive analysis of price dispersion in the grocery channel that is consistent with such a model.

[10] It would be interesting to also study the impact of carry-over effects for consumers in this context of targeted advertising. Note that there is some evidence that in many low involvement categories (like cookies, potato chips, and ready-to-eat cereal), the main driver of brand choice is top-of-mind awareness (Dickson and Sawyer 1990).

The equilibrium probability (or frequency) of advertising decreases with the cost of advertising and increases with the reservation price. It is also easy to see that $\partial F(p)/\partial h < 0$ and $\partial F(p)/\partial A < 0$. Thus, the expected price increases with both market differentiation (the size of the h segment) and advertising costs. The relationship between α^* and market differentiation is more interesting: the frequency of advertising decreases with the size of the comparison shopping segment (i.e., lower differentiation) when $A < r/2$. However, advertising frequency increases in the size of the comparison shopping segment when $A > r/2$. This reversal can be explained by two effects that higher advertising frequencies have on the nature of competition. First, higher advertising frequencies increase the fraction of comparison shoppers that are informed about both firms (α^2). This raises the incentive to price aggressively because fully informed comparison shoppers compare prices and buy from the firm with the lowest price. The second effect of increased advertising frequency is that more of the total market is able to buy each firm's product, $\partial(h+s)/\partial s > 0$. This provides a demand benefit to each firm.

When costs of advertising are low ($A < r/2$), firms advertise aggressively. In this case, a reduction in market differentiation (i.e., decreases in h, the size of the loyal segment) has two effects. First, it increases the fraction of each firm's demand that is competed for (each firm has more comparison shoppers relative to high preference consumers). Second, it increases total demand available to each firm ($h+s$ increases). However, reduced profits from the first effect are larger than the positive effect of a higher potential market. As a result, the optimal advertising level drops. Here, firms manage noncooperatively the degree of competition in the market by reducing the proportion of fully informed comparative shoppers. The inverse applies when advertising costs are sufficiently high ($A > r/2$). In this case, the benefit of increased demand outweighs the competitive effect. As a result, the optimal level of advertising is higher when the size of the comparison shopping segment increases.

3.2. Competition with Targeted Advertising

We now analyze the main issue of this paper pertaining to the ability of firms to target advertising to particular segments of the market. The advertising targeting technology being considered implies more precise media vehicles that allow firms to target advertising to specific segments of the market and better information on consumer preferences across segments.[11] In the model, this translates to the firms

being able to direct advertising to the high preference and to the comparison shopper segments separately. Given our assumption that the cost of advertising is proportional to the consumers reached, the cost of targeting the h segment of a firm is hA, while the cost of targeting the comparison shopping segment is sA.

Because firms can choose to advertise to the high preference consumers only and charge the reservation price, the guaranteed profits from the h segment are $h(r - A)$. Thus firms always advertise to their h consumers as long as $r > A$. For the rest of the analysis, we assume that this holds.[12] Note that with the ability to target advertising, firms do not advertise to the other firms' h consumers as these consumers will not buy. Next, consider advertising to the comparison shopping segment. In general, advertising to this segment involves mixed advertising strategies. Suppose that both firms advertise with probability one. Then, if advertising is costly, either of the firms has an incentive to deviate by marginally reducing the frequency of advertising. While the firm's expected demand from the comparison shopping segment goes down by a small amount, all profits from this segment are dissipated when it is fully informed 100% of the time. As a result, a firm will save on the cost of advertising by reducing its frequency of advertising. Writing the probability of advertising to comparison shoppers as β, the profit function for a firm when advertising to s is $\pi(p) = hp + (1 - \beta)sp + \beta sp[1 - F(p)] - A(h + s)$. Proposition 2 summarizes the equilibrium with targeted advertising.

PROPOSITION 2. *When advertising can be targeted, and $r > A$, the equilibrium profit is $h(r - A)$ and firms advertise to their h consumers with probability one and to comparison shoppers with a probability of $\beta^* = 1 - A/r$. In addition, firms employ mixed strategy pricing with c.d.f.*

$$F^*(p) = 1 - \frac{rh + As}{s(r - A)} \frac{r - p}{p} \quad for\ p \in \left[\frac{hr + As}{h + s}, r\right].$$

First, note that the probability of advertising to the comparison shoppers β^* is strictly less than one. Therefore, when advertising can be targeted, firms advertise more to their respective high preference segments than to comparison shoppers. By targeting advertising to consumers who have a strong preference for its product, a firm increases the consumer surplus it extracts from the market. Either firm has an incentive to advertise to comparison shoppers with a probability less than one. The effect of advertising with a probability less than one is to reduce

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[11] Roy (2000) can be seen as looking only at the first effect.

[12] This simply means that the reservation value of all consumers who require advertising to become informed is greater than the cost of advertising. Otherwise, firms will not advertise, implying the degenerate case where firms find advertising infeasible.

competition for comparison shoppers. In fact, the competing firm enjoys monopoly power over these consumers when it is advertising but the focal firm is not. This has the indirect effect of reducing the intensity of price competition (which allows higher profits to be earned from the high preference segment). Thus, advertising with probability less than one helps a firm to endogenously create differentiation in the competitive part of the market. Furthermore, the direct effect of targeted advertising is to eliminate wastage caused by advertising that falls on the competitor's h segment. Consequently, as Proposition 2 shows, the ability to target advertising to specific segments leads to an increase in profit over the case of uniform advertising. Note that the advertising intensity to the comparison shopping segment increases with the reservation price because there is more surplus to extract from consumers who are reached by advertising. Targeted advertising also has interesting effects on advertising spending and pricing.

PROPOSITION 3. *Compared to the case of uniform advertising, total advertising expenditures are lower with targeted advertising when $A < r/2$ and higher when $A > r/2$.*

Advertising expenditures decrease with targeted advertising when $A < r/2$, i.e., when advertising is relatively inexpensive. However, we also find that targeting can lead to an increase in advertising expenditures when $A > r/2$. This phenomenon obtains because of the competitive context of our model and the resulting interaction of advertising and price.

The analysis highlights two effects of targeting advertising. The first is reduced wastage and the second is the creation of a more effective marketing instrument. In particular, when a firm cannot target its advertising, it cannot eliminate wasted advertising to the h customers of the competitor. When advertising is inexpensive, a firm will choose high levels (i.e., frequency) of advertising, all else being equal. Therefore, without the ability to target, inexpensive advertising means that the extent of wastage is significant. The ability to target advertising allows the firm to eliminate this wastage leading to a decrease in the overall level of expenditure. In contrast, when advertising is expensive, firms choose low levels of advertising under uniform advertising. Advertising is an ineffective marketing instrument because it is both expensive and much of it goes to the wrong potential consumers. As a result, many customers who would be willing to pay the equilibrium price are uninformed, and thus do not buy. In this case, the ability to target advertising allows firms to realize higher demand by increasing advertising to the part of the market that has interest in their respective

products. This leads to an overall increase in advertising expenditure.

It is useful to compare the above results to the monopoly analysis of Esteban et al. (2001) who find that targeting decreases advertising expenditures. This idea is similar to the first part of Proposition 3 in the sense that with targeted advertising firms can avoid advertising to consumers with lower willingness to pay for the product (given their other alternatives). However, our analysis shows that there are indeed conditions under which the inverse can happen and advertising expenditures increase when firms have the ability to target advertising.

Targeted advertising also increases the average prices that firms charge. With targeted advertising, a firm always advertises to its h segment, while advertising with probability β to comparison shoppers. Consequently, there is reduced price competition between firms, leading to higher average prices being charged in equilibrium.

3.3. Comparing Targeted Prices and Targeted Advertising

Until now, we have focused on markets where firms had the ability to target advertising but could only compete with uniform pricing strategies. This is the mainstream case of most product markets, where firms target advertising to different consumer segments through the media plan and products are sold to consumers through traditional retail channels. However, with the growth of the Internet and better point-of-sale technologies, firms increasingly have the ability to price discriminate and target specialized prices to different segments.

In this section, we examine the effect of targeted pricing and ask how it interacts with the ability of firms to target advertising. A natural way to begin this investigation is to ask what happens if firms could target price, but were restricted to uniform advertising. This case allows us to tease out the effects of advertising targeting relative to that of pricing. The case of uniform advertising and targeted pricing applies to situations where the media options to reach a target population are limited, yet consumers are easy to classify at the time of purchase. For example, a major problem for firms in developing countries is finding media vehicles that deliver a targeted audience. On the other hand, various forms of pricing (volume discounts, bundling, coupons) often allow these firms to tailor prices based on customer type. In this situation, the ability to target prices is stronger than the ability to target advertising.

Recall that when a firm advertises without targeting, the profit from charging the reservation price is $hr - A$. Therefore, following Lemma 1, if $hr > A$, then firms advertise with probability one. If $hr < A$,

then firms employ mixed advertising strategies. Similar to §3.1, we solve for a symmetric equilibrium and denote γ_u as the probability of advertising for this uniform advertising case. We then write the profit of a firm when it advertises as $hr + (1 - \gamma_u)sp + \gamma_u sp(1 - F(p)) - A$. The equilibrium profit in this case is zero, while the equilibrium probability of advertising is $\gamma_u^* = 1 - (A - hr)/(sr)$. Comparing this with the case of uniform advertising and pricing, we see that the incentive to advertise (uniformly) is unaffected in this model by the ability to set targeted prices (the equilibrium advertising is identical to the case of uniform pricing derived in §3.1). The equilibrium profits also do not change from the uniform price case. This is because while targeted pricing allows firms to increase the price charged to the high preference consumers (to the reservation price r), it also increases competition for the comparison shoppers relative to the base case. In this model, these effects cancel out and in equilibrium, firms do not benefit from targeted pricing versus the base case. With targeted pricing, the comparison shoppers are better off, while the high preference segment is worse off and pays the reservation price.

We now consider the case where firms can target both advertising and pricing. This case is directly applicable to direct marketers who offer tailored prices to consumers based on the increased availability of individual-level consumer information. Analyzing this problem helps us to understand how the ability to target advertising interacts with a firm's ability to target pricing. When firms can target both price and advertising, each firm can guarantee itself a profit of $h(r - A)$. This is because the firm can choose to send advertising only to their h segment and charge the reservation price. Similar to §3.2, firms do not advertise to the h consumers of the competitor and employ a mixed advertising strategy to the comparison shopping segment. We can write the following equilibrium condition for the comparison shopping segment (where γ_t is the probability of advertising to comparison shoppers in this case of targeted advertising): $(1 - \gamma_t)sp + \gamma_t sp(1 - F(p)) - As = 0$. Proposition 4 characterizes the equilibrium.

PROPOSITION 4. *When advertising and pricing can be targeted, the equilibrium profit is $h(r - A)$ and firms advertise to their h consumers with a probability one and to comparison shoppers with a probability of $\gamma_t = 1 - A/r$. In addition, firms employ mixed pricing strategies with $F(p) = 0$ for $p < A$, $F(p) = (r(p - A))/(p(r - A))$ for $p \in [A, r]$, and $F(p) = 1$ for $p > r$.*

In this setting, neither the advertising strategy nor profits are affected when firms that can target advertising obtain the ability to target prices. Moreover, the advertising intensity to comparison shoppers is unaffected by gaining the ability to target prices regardless of whether firms can target advertising or not. The reason is that the attractiveness of the comparison-shopping segment fully determines the incentive to advertise to it and it is a function of two things, the size of the segment and the reservation price comparison shoppers are willing to pay. This incentive is independent of whether firms can target pricing or not. The difference in the two worlds (uniform versus targeted pricing) is that with uniform pricing, the incentive to cut price is reduced because profit is lost on high preference consumers when price is lowered. Of course, firms will only reduce price to the point where the profits they earn by capturing increased demand is at least as high as the guaranteed profit.

In contrast, in the world of targeted pricing and targeted advertising, competition in the comparison shopping segment is decoupled from the high preference segments. While the incentive to advertise is unchanged by targeted pricing, the incentive to price aggressively is higher. As a result, the average price for comparison shoppers is lower in the targeted pricing world.[13] Of course, these lower prices are perfectly offset by higher prices that are charged to high preference consumers (they always pay r).

Similar to §3.2 where advertising can be targeted but prices are uniform, firms advertise to their h segment with probability one and the probability of advertising to comparison shoppers is identical. The contrasting effects of targeting for both pricing and advertising are summarized in Table 1. The benefit of targeted pricing is the ability to charge reservation prices and extract surplus from the high preference segment. However, targeted pricing also increases price competition for comparison shoppers because a firm can reduce price to these consumers without reducing the price to its h segment. The results shown in Table 1 demonstrate that these effects cancel out. In this model, the profits of firms are unaffected by having the ability to set targeted prices regardless of whether advertising is uniform or targeted (see also Winter 1997, Corts 1998).

3.4. Incentives to Invest in Targeting Capability

We now consider the situation where firms incur a fixed cost to acquire the ability to target their advertising. Most often this consists of purchasing targeting information from market research firms, purchasing information technology to better understand the

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[13] Note that the pricing distribution with uniform pricing first order stochastically dominates the pricing distribution for comparison shoppers with targeted pricing. This implies that the average price under uniform pricing is strictly greater than the average price for comparison shoppers under targeted pricing.

Table 1 **Equilibrium Outcomes as a Function of Targeting** ($\delta = 0$)*

	Advertising probabilities by segment and profits Range: $A > hr$			
Advertising	Case 1: Uniform advertising, uniform pricing	Case 2: Targeted advertising, uniform pricing	Case 3: Uniform advertising, targeted pricing	Case 4: Targeted advertising, targeted pricing
Advertising (h)	$1 - \dfrac{A - hr}{sr}$	1	$1 - \dfrac{A - hr}{sr}$	1
Advertising (s)	$1 - \dfrac{A - hr}{sr}$	$1 - \dfrac{A}{r}$	$1 - \dfrac{A - hr}{sr}$	$1 - \dfrac{A}{r}$
Profits	0	$h(r - A)$	0	$h(r - A)$

*With targeted pricing, the price to the h segment is r and the price to the s segment is in mixed strategies.

media behavior of consumers, or incurring the cost of using an advertising agency.

Assume that firms can make an ex ante investment f to acquire the ability to target advertising. This game can be represented as a two-stage game, where firms first decide whether or not to invest in targeting and then compete in advertising and price. To analyze this situation, we first identify the optimal strategies as a function of firm capabilities. Note that the optimal strategies when both firms use uniform advertising and when both firms target advertising are described in §§3.1 and 3.2. Thus, to complete the analysis, we analyze the case where a firm with targeting capability (say, Firm 1) faces a firm that can only advertise uniformly (Firm 2). We first solve the price and advertising subgame and then analyze the decision to make the investments to target advertising.[14] Let β_1 be the probability that Firm 1 advertises to comparison shoppers (it advertises to its high preference segment with probability 1) and α_2 be the probability that Firm 2 advertises uniformly to the market. In this situation, when both firms advertise to comparison shoppers, the firms' prices are in mixed strategies, because each firm has an incentive to undercut the other to attract comparison shoppers. We start the equilibrium characterization with Lemma 2.

LEMMA 2. *The outcome with both $\alpha_2 = 1$ and $\beta_1 = 1$ cannot be part of the equilibrium.*

Suppose Firm 2 (the uniform advertising firm) advertises with probability one. Then, Firm 1 (the targeting firm) earns a higher profit by advertising with a probability less than one to the comparison

shoppers. When Firm 2 is already reaching all the consumers in the market, reducing the advertising to comparison shoppers helps Firm 1 to reduce the level of market competition. Thus, there are three possible cases: two cases where either one of the firms advertises with probability less than one (while the other advertises with probability one) and the third case in which both the firms advertise with probability less than one. The derivation of all the cases are provided in the appendix. Proposition 5 provides the details of the equilibrium. The superscript n on the profit for Firm 1 indicates that the expression pertains to the price and advertising subgame before the investment decision f.

PROPOSITION 5. *When only Firm 1 targets its advertising, there are two possible types of equilibria: either $\beta_1 < 1$ and $\alpha_2 = 1$ or $\beta_1 = 1$ and $\alpha_2 < 1$. Furthermore, Firm 1 always advertises to its h segment with probability one.*

(1) *For low cost of advertising $0 < A < hr$, the equilibrium involves $\beta_1 = 1 - A/r$ and $\alpha_2 = 1$. Firm 1's profits are $\pi_1^n = h(r - A)$ and Firm 2's profits are $\pi_2 = rh - A(1 - s)$.*

(2) *For high cost of advertising $A > r/2$, the equilibrium involves $\beta_1 = 1$ and $\alpha_2 = 1 - (A - hr)/(sr)$. Firm 1's equilibrium profits are $\pi_1^n = A - A(h + s)$, while Firm 2 makes zero profit.*

(3) *For intermediate costs $hr < A < r/2$, both types of equilibria are possible. But the equilibrium with $\beta_1 < 1$ and $\alpha_2 = 1$ Pareto dominates the equilibrium with $\beta_1 = 1$ and $\alpha_2 < 1$.*

When the costs of advertising are sufficiently low ($A < hr$), the equilibrium involves $\beta_1 < 1$ and $\alpha_2 = 1$. With lower costs of advertising, the firm with uniform advertising always advertises. In response, the firm with the ability to target advertising chooses $\beta_1 < 1$ to reduce competition for comparison shoppers (β_1 also decreases in A in this range). At the other extreme, when the cost of advertising is sufficiently high ($A > r/2$) the equilibrium involves $\beta_1 = 1$ and $\alpha_2 < 1$. The firm with uniform advertising finds it too expensive to advertise with probability one. In contrast, the ability to target advertising and eliminate wasted advertising allows Firm 1 to always advertise. Finally, in the intermediate range of A, both types of equilibria are possible. However, the equilibrium with the targeting firm advertising with probability less than one and the uniform firm always advertising is Pareto dominant. While analyzing the decision to invest in targeting, we pick the Pareto dominant equilibrium as the relevant one when advertising costs are in the intermediate range.

The above results highlight some interesting aspects of competition between the two firms that have different capabilities. For A above $r/2$, the inability of Firm 2 to always advertise confers a positive externality on Firm 1. Firm 1 makes $A - A(h + s)$, which

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[14] As mentioned in the previous section, we restrict our attention to the range of advertising costs, which rule out the degenerate case where firms with uniform advertising ability do not advertise; i.e., $A < (1 - h)r$.

is strictly greater than the profit earned by only serving its high preference segment. In other words (from the perspective of Firm 1), all potential profit on comparison shoppers is dissipated when advertising costs are low enough because Firm 2 finds it optimal to always advertise. When advertising costs are high, the reduced advertising by Firm 2 mitigates the competition for the comparison shoppers. Firm 1's profit is increasing in A when $A > r/2$. Here, even though an increase in A makes it more expensive for Firm 1 (the target advertising firm) to advertise, it also has the effect of making Firm 2 (the uniform advertising firm) to advertise less. For Firm 1, the impact on profits of having a weaker competitor outweighs the added cost of communicating with the market.

We now analyze the decisions of the firms to invest f to obtain targeting capability. Figure 1 illustrates the payoffs of the firms based on their decisions to either invest or not invest in targeting capability. In this Figure, π_u is the profit where both firms use uniform advertising, π_t is the profit where both firms use targeted advertising, π_a is the profit of a firm with targeting capability when its competitor does not, and π_d is the profit of a firm that uses uniform advertising against a firm that targets its advertising (all profit quantities are net of f).

PROPOSITION 6.

(1) *When $0 < A < r/2$, both firms will target if $f < Ah$, only one firm will target if $f \in [Ah, A(1-h)]$, and neither firm will target if $f > A(1-h)$.*

(2) *When $A > r/2$, both firms will target if $f < h(r-A)$, only one firm will target if $f \in [h(r-A), Ah]$, and neither firm will target if $f > Ah$.*

For the entire range of advertising costs there is a consistent pattern of equilibrium outcomes. Three types of equilibrium outcomes are possible. When f is sufficiently low, the equilibrium involves both firms investing in targeting. On the other hand, if the costs of targeting are high, both firms will choose to use uniform advertising and not invest in targeting. But the more interesting point is that when targeting costs are in an intermediate range, there is an asymmetric equilibrium. In other words, ex ante identical firms differentiate in the decision to acquire the ability to target advertising: while one firm makes the investment f, the other chooses not to invest and advertises

uniformly.[15] The analysis demonstrates that the benefits of targeting are greater for a firm that faces a competitor that uses uniform advertising than for a firm that faces a competitor that has targeting capability.

3.5. Positive Endowment of Consumer Information

In the preceding analysis, we assume that without advertising from a firm, consumers are not informed of the firm's product and do not consider its purchase. In this section, we relax this assumption to allow for consumer product knowledge even in the absence of advertising. This reflects the fact that in many markets, consumers have knowledge about products and might consider a product even in the absence of advertising. In particular, let a fraction δ_h of the high preference consumers of each firm be informed without advertising, while a fraction δ_s of the comparison shoppers are similarly informed about both products. This implies that each firm will have a group of $(1-\delta_h)h$ high preference consumers who are uninformed and who need advertising to be activated to consider buying the product. Similarly, the fraction $(1-\delta_s)s$ of comparison shoppers need advertising to be informed and to consider buying one of the two products.

Because a firm can potentially sell even without advertising, the pricing strategy of a firm is conditional on whether it is advertising or not. Denote the c.d.f. of firm i's mixed strategy price distribution without advertising to be $G_i(p)$ and with advertising to be $F_i(p)$. Consider the case of uniform advertising. If both firms are not advertising, then a firm's profit function is $\pi_i(p) = \delta_h hp + \delta_s sp(1 - G_j(p))$. In this case, a firm by charging the reservation price can guarantee itself a profit of $\delta_h hr$. Next, when both firms advertise in equilibrium, the profit of Firm i while charging p will be $\pi_i(p) = hp + sp(1 - F_j(p)) - A$. Thus, the firm while advertising can charge the reservation price and guarantee itself a profit of $hr - A$ and if this profit is greater than $\delta_h hr$, firms will always advertise in equilibrium. Then, as in the previous analysis, we have that firms will advertise with probability one if $A < hr(1 - \delta_h)$. If advertising is sufficiently expensive and $A \geq hr(1 - \delta_h)$, the equilibrium will involve mixed advertising strategies. For this case, the profit of a firm is then $\pi_i(p) = hp + \delta_s sp[(1 - \alpha_j)(1 - G_j(p)) + \alpha_j(1 - F_j(p))] + (1 - \delta_s)[(1 - \alpha_j)sp + \alpha_j sp(1 - F_j(p))] - A$. From this the symmetric equilibrium condition

Figure 1   Normal Form of Decision to Invest to Obtain Targeting Capability

		Firm 2	
		Uniform	Targeted
Firm 1	Uniform	π_u, π_u	$\pi_d, \pi_a - f$
	Targeted	$\pi_a - f, \pi_d$	$\pi_t - f, \pi_t - f$

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[15] This might be seen as related to Mills and Smith (1996) who argue that asymmetric firms arise endogenously if the fixed costs to acquire a lower marginal cost of production are in an intermediate range. Note, however, that while a firm having lower costs always hurts the competitor, in this paper, a firm investing in targeting ability benefits the competitor if the competitor does not have targeting ability.

will be $hr + (1 - \delta_s)(1 - \alpha)sr - A = \delta_h hr$. The equilibrium advertising can be calculated to be $\alpha^* = 1 - (A - hr(1 - \delta_h))/((1 - \delta_s)sr)$. It can be seen that the equilibrium probability of advertising decreases with both δ_h and δ_s.

Consider the case when firms can target advertising. If they choose to advertise only to the high preference consumers, they can guarantee themselves a profit of $hr - hA$. By not advertising at all and charging the reservation price, they can obtain a guaranteed profit of $rh\delta_h$. Thus firms will always advertise to the high preference consumers if $r(1 - \delta_h) > A$. Otherwise, in contrast to the basic model above, they will not advertise at all to the high preference consumers. The equilibrium of this model is stated in Proposition 7.

PROPOSITION 7.

(1) *With targeted advertising, firms will always advertise to their high preference consumers if $\delta_h < 1 - A/r$ and will never advertise to them if $\delta_h > 1 - A/r$.*

(2) *Firms will advertise to the comparison shopping segment with probability $\beta^* = 1 - A/((1 - \delta_s)r)$.*

In markets where the fraction of consumers who do not need advertising is sufficiently small (and if advertising is not very expensive), firms always advertise to the high preference consumers, but advertise to the comparison shoppers with probability less than one. This result is analogous to the result of the basic model that firms will advertise more to their high preference segment than to comparison shoppers. However, if the fraction of high preference consumers who are already informed without advertising is sufficiently large, firms with the ability to target advertising will not advertise to these consumers. This implies that in equilibrium (contrary to the basic model), firms advertise less to the high preference consumers than to the comparison shoppers. Basically, when a significant proportion of the high preference consumers are endowed with information, it is as if the firms are advertising to them costlessly. Consequently, firms do not find it optimal to employ costly advertising to their high preference segment. It is also useful to note that the probability of advertising to the comparison shoppers decreases with δ_s, the fraction that is already informed about the available products.

3.6. Targeting with Leakage

Consider now the case of imperfect targeting, where advertising targeted by a firm to a specific segment might leak to other segments. This leakage might represent the lack of availability of media vehicles that perfectly target advertising to a given segment. Let ρ be the extent of leakage, which is the probability that the advertising does not fall on the targeted segment, and assume $s < 2h$ and $\rho < s + h$ (if a firm targets

a segment, then that segment should not receive worse than random exposure). Let $\Pr(x \mid y)$ denote the probability that the advertising targeted at segment y falls on segment x, where $x, y = s, h_1, h_2$ (h_1, h_2 denote the high preference consumer segments of Firms 1 and 2, respectively). As before, the advertising technology is discrete in that a segment is either advertised to or not.

Consider the case when Firm 1 only targets advertising to its high preference segment and does not advertise to its comparison shoppers. Its cost of advertising in this case is Ah. Given the definition of leakage, the probability (i.e., the amount) that the advertising that is targeted by Firm 1 to its h actually falls on it is $\Pr(h_1 \mid h_1) = (1 - \rho)$. The probability that advertising targeted by Firm 1 to its h segment that falls on the comparison shoppers is $\Pr(s \mid h_1) = \rho h(s/(h + s))(1/s) = \rho(h/(h + s))$. Similarly, when Firm 1 targets only the comparison shoppers, it incurs a cost of As. In this case, we have that $\Pr(s \mid s) = (1 - \rho)$ and $\Pr(h_1 \mid s) = \Pr(h_2 \mid s) = (\rho s)/(2h)$.

One can then show that for some parameter values, each firm always advertises to its high preference segment but uses mixed strategy advertising to the comparison shopping segment. We then find that the effect of increasing leakage is to reduce the equilibrium profits of the firms. With zero leakage ($\rho = 0$), we recover the case of perfect targeting presented in §3.2. Finally, one can also check that targeting of advertising with leakage still implies greater equilibrium profit than the case of uniform advertising.

### 3.7. Local Retail Advertising and Some Anecdotal Evidence

Retail markets are well suited to provide anecdotal support for our analysis because they are characterized by the interplay of numerous consumer segments, each of which has different degrees of preference for the stores in a given area. In addition, the majority of advertising by retailers is informative in nature, i.e., it informs consumers about sales events and specials for different categories of goods at the retailer. The anecdotal evidence presented here is based on a series of detailed interviews with marketing managers of CORA, Casino, and Carrefour (three of the largest retailer chains in France). The analysis suggests that because firms benefit from targeted advertising, we should observe firms making significant investments to obtain the ability to target advertising. Second, given that firms have the ability to target, we would expect them to send higher weights of media to consumers who have a stronger predisposition to purchase their products. Finally, the model predicts that when firms can target their advertising activity, they will advertise to their high preference segments almost all of the time. In contrast, we should

observe less advertising activity to those segments that are analogous to our model's comparative shopping segment.

First, our discussions with the managers indicate that significant resources are dedicated to identifying and understanding the key segments for each store. Each store constructs a patronage map in which the retail trading area for each store (in terms of the strength of their franchise) is divided into primary (high preference), secondary, and tertiary territories (comparison shoppers). Figure 2 shows a representative map for an urban area in central France. To construct maps for each store, the hypermarchés use independent researchers to conduct in-store surveys (at the check out) and analyze loyalty and credit card purchases. In addition, Information Systems for Direct Marketing, Inc. (ISDM), a market research firm, estimates "zones de bascule" for retailers. Roughly translated, these can be thought of as "zones of switchers." ISDM divides the entire country into pockets of 300 households and using a combination of survey data, driving distances, and traffic density designates "zones de bascule" for participating retailers. The main point is that retailers obtain the ability to target through significant fixed investments in market research, analysis, and integrating information from different sources. As assumed in the model, this ability has been facilitated by advances in information technology. These costs are unrelated to the quantity of local advertising (or media) that is ultimately purchased.

Second, the media strategies employed by the retailers echo the predictions of the model. The local advertising efforts are summarized in Table 2. The table shows that the retailers send 100% of their advertising brochures to primary consumers (this does
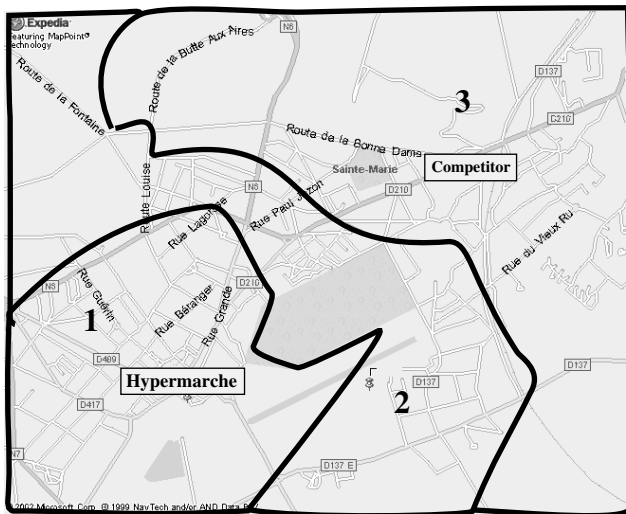
Table 2   Local Advertising Summary

Hypermarchés in France		
Theme type	Example	Objective
Regular weekly specials	Food, household items, clothing	Reward patronage, maintain image
Seasonal events	Valentine, Father's/Mother's Day, Christmas, Easter	Build traffic, reward patronage
Special events	Gardening, The Fair of Wines, summer sports	Build traffic, reward patronage
Shock specials	School supplies, baby products, food	Build traffic, generate trial

Theme type	Primary	Secondary	Tertiary
Regular weekly specials	Yes	No	No
Seasonal events	Yes	Yes	No
Special events	Yes	Yes	No
Shock specials	Yes	Yes	Yes
Total	100%	50%	>10%

Source. Interviews by the authors during January–April 2002.

not mean that every primary consumer receives an ad in every week), significantly less to secondary consumers, and less again to tertiary consumers. In particular, flyers are sent *every week* to primary (high preference) customers. Advertising levels directed to the retailer's primary customers are higher than the levels directed to consumers for whom the retailer competes intensely. Note that another force that could make the retailers advertise less to the secondary than to the primary consumers is that the secondary consumers often incur an additional disutility of going to the retailer. Finally, the managers stated that the timing of advertising to secondary and tertiary customers did not have any particular pattern. They also mentioned that they would like to know their competitor's advertising schedule "in advance" so they could schedule their activities in the competitor's off weeks. This suggests that the mixed strategy representation of advertising to comparison shoppers may be reasonable. The comments of the managers also provide evidence that managers are sensitive to the profit-reducing impact of having secondary (or tertiary) shoppers who receive flyers simultaneously. Similar to the model with uniform pricing, retail managers create differentiation by limiting the intensity of advertising to segments that compare prices.

4.   Conclusion

One of the central questions that firms face in advertising and media planning is how they should target advertising to specific consumers. How should firms allocate their media budgets between consumers who have a distinct preference for their brand and consumers who consider competing products? This paper provides a logic for why firms in competitive markets

Figure 2   Patronage Map for a Hypermarché with One Major Competitor Nearby

should target more advertising to consumers who have a distinct preference for their products. When firms reduce advertising to price-elastic consumers who comparison shop, they endogenously create additional market differentiation, which reduces the intensity of competition. The targeting of advertising also provides firms with the direct benefit of eliminating wasted advertising to consumers who have a distinct preference for the competing product. For these reasons, the ability to target advertising increases the equilibrium profits of firms.

Targeting also improves the effectiveness of advertising. By reducing the wastage created by sending advertising to consumers who are unlikely to buy, we might expect improved targeting to lead to lower advertising expenditures. The analysis shows that this conclusion might not always hold. When advertising is expensive, the inability to target advertising leads firms to make low advertising expenditures. In this case, the ability to target advertising leads to higher advertising spending because the increased effectiveness of advertising makes higher expenditures worthwhile.

An interesting implication of the analysis is that in a competitive environment, the ability to target advertising is more important for increasing firm profitability than the ability to target pricing. When firms have the ability to choose different advertising levels for different groups of consumers, it leads to higher profits independent of whether or not firms also have the ability to set targeted prices. In contrast, the ability to target prices primarily leads to increased competition for comparison shoppers. The intuition for the main messages presented here suggests that our findings should generalize to other functional forms. Firms advertise more to the consumers who have a greater preference for their product and this endogenously creates more differentiation in the market. Competing firms benefit more from targeting of advertising (which increases differentiation) than from targeting of pricing (which can be seen as reducing differentiation at each consumer).

The model also provides useful implications for managers. First, a standard dilemma for marketing managers is that most marketing initiatives only provide a temporary advantage over the competition. Once the competition reacts to an initiative, the advantage is lost and frequently, firms have simply increased their cost of doing business. In contrast, the ability to target advertising provides benefits that are not lost when competitors respond by implementing targeting of their own. Because of reduced waste, targeted advertising can simultaneously make all firms better off. Second, as noted above, in a competitive environment, the ability to target advertising is more valuable than the ability to price discriminate.

Targeting allows a firm to send advertising to consumers who really like its products and this has minimal competitive implications. This finding provides strong impetus for managers to dedicate significant effort to improving performance in media buying through the integration of research on consumer preferences and media habits. Finally, the ability to target advertising does not necessarily mean that advertising spending will drop as implied in Esteban et al. (2001). When advertising is both expensive and uniform, its effectiveness as a marketing instrument is limited. As the precision and frequency of targeted advertising within an industry increases, managers may find that advertising budgets need to be increased. This provides a prescription for setting the allocation of budgets across media vehicles. With better targeting, the advertising spending on more expensive media vehicles can increase. Finally, as a potential extension, it would be interesting to evaluate the effects of targeting when firms are asymmetric in terms of the size of their high preference segments.

Acknowledgments

Appendix
PROOF OF PROPOSITION 1. We look for the symmetric equilibrium of the competition between the two firms. Let the probability with which firms advertise be α. Then, when a firm advertises, from the profit function $\pi(p) = hp + (1-\alpha)sp + \alpha sp(1-F(p)) - A$, the guaranteed profit of a firm from charging the reservation price r will be $hr + (1-\alpha)sr - A$. Equating this to the profits when the firm does not advertise, we have the equilibrium of $\alpha^* = 1 - (A - hr)/(sr)$.

A possible totally mixed strategy equilibrium pricing strategy is the following: Each firm can charge a price according to some continuous c.d.f. $F(p)$ with support between r and some lower bound z. To derive the equilibrium price distribution, substitute α^* into the firm's profit function to obtain

$$F(p) = 1 - \frac{r-p}{p}\left[\frac{A}{(s+h)r - A}\right].$$

To identify the minimum price in the distribution, note that when a firm charges the minimum price, we have $\pi(z) = zh + (1-\alpha)zs + \alpha zs - A = 0$. From this, the minimum price can be derived to be $z = A/(1-h)$ after recalling that $s = 1 - 2h$.

PROOF OF PROPOSITION 2. Each firm can earn a guarantee of $h(r - A)$ by targeting advertising only to its high preference segment and charging the reservation price. Denote

by β the probability of advertising to the comparison shoppers. The profit to a firm while also advertising to the comparison shopping segment is given by $\pi(p) = hp + (1-\beta)sp + \beta sp[1 - F(p)] - A(h+s)$. By considering the profit when a firm is also advertising to the comparison shopping segment and charging the reservation price and equating this to the guaranteed profit when not advertising to the comparison shoppers, we have the equilibrium condition

$$\pi(r) = rp + (1-\beta)sr - A(h+s) = h(r-A). \qquad \text{(i)}$$

From this, the equilibrium probability of advertising to the comparison shoppers can be derived to be $\beta^* = 1 - A/r$. Given this, the equilibrium price distribution can be easily derived by using a procedure that is similar to the one shown for Proposition 1.

PROOF OF PROPOSITION 3. It follows directly from comparing the total advertising in Propositions 1 and 2.

PROOF OF PROPOSITION 4. Similar to Proposition 2, each firm earns a guaranteed profit of $h(r-A)$ by targeting advertising to its high preference consumers only and charging r. Following the reasoning of Lemma 2, an equilibrium where both firms employ pure advertising strategies to comparison shoppers does not exist. Thus, the equilibrium condition for comparison shoppers shown in the text. The reservation price r is the upper bound of the c.d.f. of the mixed pricing strategy for comparison shoppers when a firm advertises. Substitute into the equation to obtain $\gamma_t = 1 - A/r$. Substitute back into the indifference equation for the prices for the comparison shoppers to derive $F(p) = (r(p-A))/(p(r-A))$. The lower limit of the c.d.f. obtains when $F(p) = 0$, which implies that $z = A$.

PROOF OF LEMMA 2. When $A < hr$, firm profits are $hr - A$ when advertising is uniform and $h(r-A)$ with targeted advertising. $V_{ta} = \pi_{ta} - \pi_{ua} = A(1-h)$. When $A > hr$, firm profits are zero with uniform advertising and $h(r-A)$ with targeted advertising. Hence $V_{ta} = h(r-A)$.

PROOF OF LEMMA 3. Suppose Firm 1 has the ability to target while Firm 2 employs uniform advertising. Assume that Firm 1 advertises to the comparison shoppers with probability $\beta_1 = 1$ and Firm 2 advertises uniformly with probability $\alpha_2 = 1$ (note that it is the case that Firm 1 always advertises to its high preference consumers). Let $W_i(p)$ $(i = 1, 2)$ be the probability that Firm i is charging a price above p. Using standard arguments as in Narasimhan (1988), the price support of both the firms are identical and in (z, r). For any price p, the profit functions are as follows:

$$\pi_1(p) = hp + spW_2(p) - A(h+s), \qquad \text{(ii)}$$

$$\pi_2(p) = hp + spW_1(p) - A. \qquad \text{(iii)}$$

Given that $\alpha_2 = 1$ and $\beta_1 = 1$, Firm 1 can only charge r if Firm 2 has a mass point at r, because otherwise Firm 1 when charging r would be better off by setting $\beta_1 = 0$. Let Firm 2 charge r with some positive probability q_2. Considering Firm 2's profits at the extreme prices, we have the equilibrium condition $\pi_2(r) = hr - A = \pi_2(z) = (h+s)z - A$. From which we get $z = (hr)/(h+s)$. Firm 1's profit when charging r will be $\pi_1(r) = hr + srq_2 - A(h+s)$, and when charging z will be $\pi_1(z) = hz - A(h+s)$. From this, we have that in any equilibrium $hr + srq_2 - A(h+s) = hr - A(h+s)$,

which can only be true if $q_2 = 0$. But this contradicts our assumption that $q_2 > 0$. Therefore, an equilibrium with $\alpha_2 = 1$ and $\beta_1 = 1$ is not possible.

PROOF OF PROPOSITION 5.

Case i. Let $\beta_1 < 1$ and $\alpha_2 = 1$. From standard arguments as in Narasimhan (1988), the price support of the firms will still be (z, r). As in the proof of Lemma 2 above, with $\alpha_2 = 1$, Firm 1 when advertising cannot charge r unless Firm 2 is charging r with some positive probability q_2. Thus, for Firm 1 when advertising to the comparison shoppers and charging r, we have $\pi_1(r) = hr + q_2 - A(h+s)$, and when charging z is $\pi_1(z) = (h+s)z - A(h+s)$. Firm 1, when not advertising, can charge r and make a guaranteed profit of $h(r-A)$. From this, we have that in equilibrium $z = (hr + As)/(h+s)$ and $q_2 = A/r$. Firm 2's profit is given by $\pi_2(p) = hp + (1-\beta_1)sp + \beta_1 spW_1(p) - A$. When Firm 2 chooses z, we have $\pi_2(z) = (h+s)z - A = hr - A(1-s)$. From this and from considering Firm 2's profits at r, we get $\beta_1 = 1 - A/r$. The equilibrium profits are $\pi_1 = h(r-A)$ and $\pi_2 = hr - A(1-s)$. The conditions for the feasibility of this case obtains from the requirements $hr - A(1-s) > 0$, which is $A < r/2$.

Case ii. Consider next the case $\beta_1 = 1$ and $\alpha_2 < 1$. Firm 2's profit for any p in the support when advertising is $\pi_2(p) = hp + spW_1(p) - A$. Given that its profit when not advertising is zero, we have the equilibrium condition $\pi_2(p) = 0$. When Firm 2 advertises and charges z, we have that $hz + sz - A = 0$ from which $z = A/(h+s)$. Next, we have that Firm 1's profit for any price p in the support is $\pi_1(p) = hp + \alpha_2 spW_2(p) + (1-\alpha_2)sp - A(h+s)$. This means that $\pi_1(z) = (h+s)z - A(h+s) = A - A(h+s)$. To derive the equilibrium α_2, note that $\pi_1(r) = hr + (1-\alpha_2)sr - A(h+s) = A - A(h+s)$. Therefore $\alpha_2 = 1 - (A - hr)/(sr)$. The equilibrium profits are $\pi_1 = A - A(h+s)$ and $\pi_2 = 0$. The condition for the feasibility of this case obtains from the requirement $\alpha_2 < 1$, which implies $A > hr$.

Finally, consider the case $\beta_1 < 1$ and $\alpha_2 < 1$. We can show that this will not be an equilibrium. Firm 1, when not advertising, can charge the reservation price and guarantee itself a profit of $\pi_1 = h(r-A)$ and similarly, the guaranteed profit of Firm 2 is zero. When advertising, Firm 1's profit function can be written as $\pi_1(p) = hp + \alpha_2 spW_2(p) + (1-\alpha_2)sp - A(h+s)$. The minimum price z_1 for Firm 1 will therefore be given by $hz_1 + sz_1 - A(h+s) = h(r-A)$, which gives $z_1 = (hr + As)/(h+s)$. Similarly, the profit function of Firm 2 when advertising is $\pi_2 = hp + \beta_1 spW_1(p) + (1-\beta_1)sp - A$. The minimum price z_2 that Firm 2 can charge will then be given by $hz_2 + sz_2 - A = 0$. From this, we have $z_2 = A/(h+s)$. In general, we can see that $z_1 \neq z_2$. This cannot be part of an equilibrium because the firms must be charging the same minimum price in equilibrium. Let $z_1 > z_2$ and so let the candidate minimum price be z_1 for both firms. In this case, given Firm 1's strategy, Firm 2 will be making greater than zero profits (which it makes when not advertising). This violates the equilibrium condition for Firm 2. Similarly, if $z_1 < z_2$, the candidate minimum price for both firms will be z_2. In this case, Firm 1 will be making greater profits than $h(r-A)$, which violates the equilibrium condition.

PROOF OF PROPOSITION 6. To analyze the equilibrium to the game of Figure 1, we identify firm profits for each of the outcomes. These are summarized in Table A1.

Table A1   Summary of Profits

	Both uniform	Targeting/uniform		Both targeted
Region for A	π_u	$\pi_a - f$	π_d	$\pi_t - f$
$0 < A < r/2$	$hr - A$	$h(r - A) - f$	$hr - A(1 - s)$	$h(r - A) - f$
$r/2 < A < r(h + s)$	0	$A - A(h + s) - f$	0	$h(r - A) - f$

Note. Profits are based on Propositions 1, 2, and 5.

When $0 < A < r/2$

(1) Both firms choosing uniform advertising is the equilibrium when $\pi_u > \pi_a - f$ and this implies that $hr - A > h(r - A) - f$. Simplifying, this becomes $f > A(1 - h)$. Therefore, $f > A(1 - h)$ implies that neither firm invests to obtain targeting capability.

(2) Targeting/Uniform is the equilibrium when $\pi_u < \pi_a - f$ and $\pi_d > \pi_t - f$. Substituting, these conditions imply that $hr - A < h(r - A) - f$ and $hr - A(1 - s) > h(r - A) - f$, respectively. Simplifying, this becomes $f < A(1 - h)$ and $f > Ah$. Because $h < \frac{1}{2}$, these conditions define an interval where only one firm invests to obtain targeting capability.

(3) Both targeting is the equilibrium when $\pi_d < \pi_t - f$, which implies $hr - A(1 - s) < h(r - A) - f$. Simplifying, this becomes $f < Ah$.

When $A > r/2$

The solution procedure is similar to the case above.

PROOF OF PROPOSITION 7. When advertising to only the high preference segment and charging r, a firm can guarantee itself a profit of $hr - hA$. By not advertising at all but charging the reservation price, it can obtain a profit of $\delta_h hr$. Therefore, a firm will always advertise to its high preference segment if $hr - hA > \delta_h hr$ and will never advertise to them if $hr - hA < \delta_h hr$. In rearranging these inequalities, we get the conditions in the first part of the proposition.

To establish the equilibrium advertising to the comparison shopping segment, consider the case when $hr - hA > \delta_h hr$ and the firm is always advertising to its h segment. Now when the firm is advertising to the comparison shoppers, it can guarantee itself a profit of $hr + sr(1 - \beta) \cdot (1 - \delta_s) - A(h + s)$ and when not advertising to the comparison shoppers but charging the reservation price, it can make $hr - hA$. Thus, in a mixed strategy equilibrium, we have that $hr + sr(1 - \beta^*)(1 - \delta_s) - A(h + s) = hr - hA$, from which the equilibrium advertising to the comparison shoppers is $\beta^* = 1 - A/((1 - \delta_s)r)$.

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