A Dynamic Model of Targeted Advertising

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Abstract

The literature on advertising assumes that advertising is either 'persuasive' or 'informative.' This paper proposes a framework for endogenizing firms' decisions on which method of advertising to adopt. Thus, we model targeted advertising when firms are unable to make their product appealing to the entire consumer population, while letting the consumer population size vary over time. This framework is then applied to modeling comparison advertising.

Key Words: Targeted Advertising, Comparison Advertising

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"Hardly any business practice causes economists greater uneasiness than advertising."
Telser (1964)

1 Introduction

The literature on advertising assumes that the advertising may take two forms: First, advertising can be *persuasive* in its nature and it is designed to alter consumers' tastes for the purpose of increasing the demand for the advertised product. The second type of advertising is called *informative* and it is designed for providing consumers the information about the characteristics of the advertised brand, its price, and where to get it. Thus, the literature on advertising always treats the nature of advertising as exogenously given, thereby ignoring the question how do brand producing firms choose their method of advertising and how do they choose which group of consumers to target with their advertising.

Our underlying observation is that societies are composed of heterogeneous consumers with different rankings (preferences) over products'. Thus, a firm is unable to advertise and sell its brand to all types of consumers. Therefore, firms must limit the scope of their advertising by choosing a narrow group of consumers for which their advertising appeals to. There may be three reasons for that: First, it is impossible to classify products' attributes that are (highly) valued by *all* consumers. Secondly, given the high cost of advertising, firms and advertising agencies may find it profitable to narrow the scope of advertising to a limited group of consumers. Thirdly, ignoring advertising costs, since product differentiation may facilitate price competition, firms may intentionally choose to target a limited consumer group.

The purpose of this paper is to propose a framework for modeling firms' choice of advertising methods and the targeted consumer group, where firms' advertising must

be confined to choosing a single advertising method and therefore a single consumer target group. For example, a firm may choose to advertise its brand by emphasizing one attribute of the product which is preferred by at least one consumer group but is not found in a competing brand. Alternatively, instead of advertising the product's attributes, a firm may target its advertising to a certain age group (young or old) or to inexperienced consumers and ignore the (attributes) quality differences among the competing brands.

The problem addressed in this paper is how do firms choose their advertising method and the resulting targeted consumer group. The paper shows that the answer depends on the rate of change in the consumer population as well as the distribution of preferences over the advertised brands. Thus, this paper proposes a method for endogenizing firms' decisions on which advertising method to use under different market conditions.

The economics literature distinguishes between two exogenously given types of advertising: *persuasive advertising* and *informative advertising*. Persuasive advertising intends to alter consumer tastes for a certain product. Informative advertising carries basic product information such as characteristics, prices, and where to buy it. Earlier authors, e.g. Kaldor (1950), viewed advertising as persuasive and held the idea that advertising is 'manipulative' and reduces competition and is therefore welfare reducing for two reasons: First, advertising would persuade consumers to wrongly believe that identical products are differentiated because the decision which brand to purchase depends on consumers' perception of what the brand is rather than on the actual physical characteristics of the product. Therefore, prices of heavily advertised products would rise far beyond their cost of production. Secondly, advertising serves as an entry deterring mechanism, since any newly entering firm must extensively advertise in order to surpass the reputation of the existing firms. Thus, existing firms use advertising as an entry deterring strategy, and can maintain their dominance while keeping above

normal profit levels. More recently, Dixit and Norman (1978) developed a simple model of persuasive advertising, where advertising results in a upward shifted demand, and showed that firms choose to advertise at above the socially optimal level.

More recent authors after Kaldor, Telser (1964), Nelson (1970, 1974), Schmalensee (1978) and Demsetz (1979) proposed that advertising is informative since it serves as a tool for transmitting information from producers to consumers about differentiated brands, thereby reducing consumers' cost of obtaining information where to purchase their most preferred brand. Recent models have been developed by Butters (1977), Schmalensee (1978) and Grossman and Shapiro (1984), see a literature survey in Schmalensee (1986).

Nelson (1970) distinguishes between two types of goods: *search goods* and *experience goods*. Search goods are those in which consumers can identify the quality and other characteristics of the product before the actual purchase. Experience goods are those that consumers cannot learn about their characteristics before the actual purchase. Note that this distinction is not really clear-cut, since we cannot fully judge the quality of a tomato (commonly viewed as a search good) until we eat it, and we cannot fully judge the quality of the shirt until after the first wash!

What Nelson claimed is that the effects of advertising may vary between these two groups of products, since consumers do not depend on information from the manufacturers to tell them about search products (because consumers find it by themselves). However, consumers do rely on advertisements when they purchase experience goods since (disregarding consumer magazines) consumers must rely on advertisements as the source of information on the products. Several tests have also confirmed that advertising of experienced products is more intensive (in terms of the ratio of advertising expenditure to sales) than advertising on search goods.

Finally, another interpretation for informative advertising is offered in Nelson (1974), Kihlstrom and Riordan (1984), Milgrom and Roberts (1986), and Schmalensee

(1978), where informative advertising serves as a signal of quality.

The present paper investigates which method of advertising and/or what type of consumer groups are targeted by firms' advertising under different market conditions, that is, when the potential market (number of consumers) expands or contracts? The dynamic setup makes it possible to investigate the effects of market size changes on firms' advertising strategy. We develop a consumer overlapping generations model where firms live forever and advertise in alternating periods. A firm can choose between two advertising methods: (a) Using persuasive advertising which would cause new (inexperienced) consumers to purchase the brand regardless of whether the advertised brand is their ideal brand or the less preferred brand. (b) Using informative advertising thereby causing the consumers who are oriented towards the advertised brand to purchase their ideal brand.

Thus, persuasive advertising ('try my brand and you'll be introduced to a wonderful product') is intended for targeting the consumers who are first time users and therefore cannot (fully) compare the brands to find out which firm sells their ideal brand. In contrast, informative advertising is intended for targeting 'old' experienced users, (the consumers who have already purchased the product in the past), and in some cases also the specific brand oriented newly entering consumers (who can be attracted to purchase the brand by the information contained in the ad). This type of advertising informs the experienced users about the difference between what they have purchased in the past and their ideal brand. Since the experienced consumers have purchased the product before, advertising targeting the experienced consumers involves providing more information regarding the technical features thereby leading these users to choosing their ideal brand.

The paper is organized as follows. Section 2 develops a dynamic model where firms are engaged in a market share competition using the two types of advertising strategies. Section 3 characterizes dynamic advertising equilibrium outcomes. Sec-

tion 4 analyzes the industry when it colludes (say by employing the same advertising agency). Section 5 provides an application of the model to comparison advertising which has become increasingly popular since the mid-seventies. Section 6 concludes with a discussion of further applications for this model.

2 A Dynamic Model of Targeted Advertising

Consider a two firm infinite horizon economy. The firms produce differentiated brands denoted by $i, i = 1, 2$.

2.1 Consumers

In each period t, λ^t (λ to the power of t, $\lambda > 0$) two-period lived consumers enter the market, make (or do not make) a purchase of a unit of one of the brands in *each* period of their life. After the second period of their life, the consumers leave the market forever. Consumers are divided into two types: A fraction of θ^1, of the entering consumers are called brand 1 oriented consumers, while a fraction of θ^2 are brand 2 oriented consumers, where $\theta^i \geq 0$ and $\theta^1 + \theta^2 = 1$. A brand i oriented consumer is a consumer who prefers to consume brand i over the other brand. In what follows, we refer to θ^1 and θ^2 as the 'popularity' parameters.

2.2 Firms and advertising strategies

Firms 1 and 2 live forever and maximize in each period a discounted present value of future profits. For simplicity, we assume that the period t profit level of firm i (denoted by π_t^i) is the period t number of (new and old) consumers who purchase brand i, $i = 1, 2$.

Firms are engaged in advertising. There are two types of advertising: persuasive advertising (targeting first time users) (denoted by P) and informative advertising (targeting experienced and inexperienced brand oriented consumers) (denoted by I).

Firms are assumed to alternate their moves, in the sense that firm 1 advertises in odd periods, while firm 2 advertises in even periods only.[1] If in period t it is firm i's turn to move, it can choose from a time independent action set $S \equiv \{P, I\}$. Let $s_t^1 \in S$ denote the action taken by firm 1 in some *odd* period t, and $s_t^2 \in S$ denote the action taken by firm 2 in some *even* period t. We denote by $\Pi_t \equiv < \pi_t^1, \pi_t^2 >$ the vector of period t profit levels (which equals the period t number of customers buying from each firm i, $i = 1, 2$.)

We will make use of the following terminology:

DEFINITION 1 *1. A consumer is said to be* **experienced** *in period t, if the consumer has purchased any brand in period $t-1$.*

2. A consumer is said to be **inexperienced** *in period t if either he is young (generation t) or if he is old but has not purchased any brand in period $t-1$.*

We make the following assumption:

Assumption 0 *Persuasive advertising attracts only inexperienced consumers. Formally, when firm i plays $s_t^i = P$, in period t: all the λ^t new generation t, and those old generation $t-1$ consumers that have not purchased any brand in period $t-1$ (if any) purchase brand i in period t.*

Assumption 0 implies that if firm i uses persuasive advertising in period t, a fraction of θ^j of the entering consumers are misplaced since they are brand j oriented consumers, however, they are 'persuaded' to purchase brand i.

[1] The reader may wonder why firms are modeled in this way, although alternating moves are used quite often in economics models. There are two reasons for that: First, alternating moves generates cumulating effects in the sense that a firm that advertises knows that its advertising policy is a (short-run) commitment that would influence the market share in a subsequent period. A second reason for using alternating moves is simplicity. Alternating moves seems to capture firms' decisions using very simple modeling.

In what follows, we assume that *informative* advertising always informs the experienced consumers which is their ideal brand. However, there are two possibilities of defining the effects of informative advertising on the inexperienced consumers: One way would be to assume that informative advertising has no effect on the inexperienced consumers since they cannot fully understand the information contained in informative advertising. Alternatively, we can assume that the inexperienced consumers are able to interpret informative advertising, and if firm i uses informative advertising in period t, then the $\theta^i(\lambda^t + \lambda^{t-1})$ brand i oriented young and old consumers would purchase brand i. The following two subsections discuss advertising outcomes under the two possible effects of informative advertising.

2.3 Informative advertising has no effect on inexperienced consumers

Assumption 1 *If firm i uses informative advertising in period t, then all (generation $t-1$) experienced brand i oriented consumers would purchase brand i. In this case, inexperienced consumers would not purchase any brand.*

Table 1 shows the per-period profit levels for four types of stationary actions taken by firms. The left column corresponds to the outcome where in odd periods firm 1 always plays P; and in even periods and firm 2 always plays P. Therefore, in each *odd* period t all the λ^t new consumers purchase brand 1 and λ^{t-1} (old brand 2 users) continue purchasing brand 2. In this outcome, in every *even* period t, the λ^t new consumers purchase brand 2 while the old λ^{t-1} consumers continue purchasing brand 1. In summary, under Assumption 1, when both firms play P,
$\Pi_t \equiv < \pi_t^1 \, ; \pi_t^2 > = < \lambda^t \, ; \lambda^{t-1} >$ for t odd, and $\Pi_t = < \lambda^{t-1} \, ; \lambda^t >$ for t even.

Table 1, which is based on Assumption 1, reveals that when one firm uses informative advertising, every second period a new generation of consumers does not purchase any brand in their first period of their life. For example, under the $< P, I >$ outcome, in every odd period t, firm 1 attracts all the λ^t new consumers plus all the

Period \ Outcome	$< P, P >$	$< P, I >$	$< I, P >$	$< I, I >$
$\tau - 1$ (even)	$< \lambda^{\tau-2}\,; \lambda^{\tau-1} >$	$< \theta^1\lambda^{\tau-2}\,; \theta^2\lambda^{\tau-2} >$	$< 0\,; \lambda^{\tau-1} + \lambda^{\tau-2} >$	$< 0; 0 >$
τ (odd)	$< \lambda^{\tau}\,; \lambda^{\tau-1} >$	$< \lambda^{\tau} + \lambda^{\tau-1}\,; 0 >$	$< \theta^1\lambda^{\tau-1}\,; \theta^2\lambda^{\tau-1} >$	$< 0; 0 >$
$\tau + 1$ (even)	$< \lambda^{\tau}\,; \lambda^{\tau+1} >$	$< \theta^1\lambda^{\tau}\,; \theta^2\lambda^{\tau} >$	$< 0\,; \lambda^{\tau+1} + \lambda^{\tau} >$	$< 0; 0 >$
$\tau + 2$ (odd)	$< \lambda^{\tau+2}\,; \lambda^{\tau+1} >$	$< \lambda^{\tau+2} + \lambda^{\tau+1}\,; 0 >$	$< \theta^1\lambda^{\tau+1}; \theta^2\lambda^{\tau+1} >$	$< 0; 0 >$

Table 1: Profit levels for three stationary outcomes under assumptions 0 and 1

λ^{t-1} generation $t-1$ consumers (who have not purchased in $t-1$). In every even t, firm 2 attracts all the $\theta^2\lambda^{t-1}$ generation $t-1$ (who are brand 2 oriented but purchased brand 1 in period $t-1$). Thus, under the $< P, I >$ outcome, new consumers are not matched with any brand in every even period.

Finally, under Assumption 1 we have that no consumer purchases any brand when both firms use only informative advertising, since under this assumption informative advertising irrelevant to young consumers. Subsection 2.4 demonstrates a different case where informative advertising has an effect on experienced consumers.

2.4 Informative advertising affects inexperienced consumers

In contrast to Assumption 1 we can assume that

Assumption 2 *If firm i uses informative advertising in period t, then all brand i oriented (experienced and inexperienced) consumers purchase brand i.*

Thus, the difference between Assumptions 1 and 2 is that under Assumption 2, informative advertising attracts also inexperienced consumers (oriented towards the advertised brand). Table 2 shows the profit levels of each firm under all four stationary outcomes.

The difference between Table 1 and Table 2 can be best seen when both firms use informative advertising. In this case, under Assumption 1, no consumer is matched with any brand. However, under Assumption 2, the young who are oriented towards the informatively advertised brand are matched beginning with their first period. The

Period \ Outcome	$< P, P >$	$< P, I >$	$< I, P >$	$< I, I >$
$\tau - 1$ (even)	$\lambda^{\tau-2}\,;\lambda^{\tau-1}$	$\theta^1\lambda^{\tau-2}\,;\theta^2(\lambda^{\tau-2}+\lambda^{\tau-1})$	$\theta^1\lambda^{\tau-2}\,;\lambda^{\tau-1}$	$\theta^1\lambda^{\tau-2}\,;\theta^2(\lambda^{\tau-2}+\lambda^{\tau-1})$
τ (odd)	$\lambda^{\tau}\,;\lambda^{\tau-1}$	$\lambda^{\tau}\,;\theta^2\lambda^{\tau-1}$	$\theta^1(\lambda^{\tau-1}+\lambda^{\tau})\,;\theta^2\lambda^{\tau-1}$	$\theta^1(\lambda^{\tau-1}+\lambda^{\tau})\,;\theta^2\lambda^{\tau-1}$
$\tau + 1$ (even)	$\lambda^{\tau}\,;\lambda^{\tau+1}$	$\theta^1\lambda^{\tau}\,;\theta^2(\lambda^{\tau}+\lambda^{\tau+1})$	$\theta^1\lambda^{\tau}\,;\lambda^{\tau+1}$	$\theta^1\lambda^{\tau}\,;\theta^2(\lambda^{\tau}+\lambda^{\tau+1})$

Table 2: Profit levels for three stationary outcomes under assumptions 0 and 2

young oriented towards the non-advertised brand are matched only at their second period when their ideal brand producing firm has its turn to advertise.

3 Dynamic Equilibria

Let β denote the discount factor. We define the period t firm i's present value of profits as the discounted stream of firm i's profits (depending on the firms' future actions from period t and on.)

Hence, for every odd period t, firm 1's present value of profits is recursively defined by

$$PV_t^1(s_t^1, s_{t-1}^2) \equiv \pi_t^1(s_t^1, s_{t-1}^2) + \beta\pi_{t+1}^1(s_t^1, s_{t+1}^2) + \beta^2 PV_{t+2}^1(s_{t+2}^1, s_{t+1}^2) \tag{1}$$

and for firm 2, for every even period t,

$$PV_t^2(s_{t-1}^1, s_t^2) \equiv \pi_t^2(s_{t-1}^1, s_t^2) + \beta\pi_{t+1}^2(s_{t+1}^1, s_t^2) + \beta^2 PV_{t+2}^2(s_{t+1}^1, s_{t+2}^2) \tag{2}$$

We formally define the firms' actions:

DEFINITION 2 *1. Firm 1's decision in odd period t is the function* $s_t^1(s_{t-1}^2)$, $s_t^1 : \{P, I\} \mapsto \{P, I\}$.

2. Firm 2's decision in even period t is the function $s_t^2(s_{t-1}^1)$, $s_t^2 : \{P, I\} \mapsto \{P, I\}$.

We seek a perfect equilibrium in the above strategies. Given the structure of the model, following Maskin and Tirole (1987) and (1988), we restrict the analysis to Markov Perfect Equilibria.

DEFINITION 3 *An equilibrium is the sequences of decision functions* $\{s_t^1\}_{t\text{odd}}$ *and* $\{s_t^2\}_{t\text{even}}$ *such that for every odd period* t, s_t^1 *maximizes (1); and for every even period* t, s_t^2 *maximizes (2).*

3.1 Advertising equilibria when informative advertising does not affect inexperienced consumers

We now characterize three stationary equilibria (also found in Table 1). In the first equilibrium, both firms use persuasive advertising thereby targeting only the new consumers (both play P). In the second equilibrium, firm 1 targets first time users by playing P, while firm 2 always targets the experienced misplaced users by playing I. In this equilibrium, in each odd period t all genrations t and $t-1$ consumers buy brand 1, and in even periods the new consumers do not purchase in their first period, but, all the generation $t-1$ misplaced brand 2 oriented consumers switch from purchasing brand 1 to purchasing brand 2. The third equilibrium is the polar case of the second equilibrium in which in every even period t all generation t and $t-1$ consumers purchase brand 2, while in odd periods, all the previous period misplaced (brand 1 oriented) brand 2 users switch to buying brand 1.

The following proposition characterizes long-term equilibria. The proof is provided in the appendix.

Proposition 1 *1. If the consumers' growth parameter is large, (i. e. ,* $\lambda > \max\{\frac{\theta^1}{1+\beta}; \frac{\theta^2}{1+\beta}\}$*) then both firms playing* P *constitutes a unique equilibrium.*

2. If the consumers' growth parameter is small relative to the fraction of brand 2 oriented consumers but is large relative to the fraction of brand 1 oriented consumers (that is, $\frac{\theta^1}{1+\beta} < \lambda < \frac{\theta^2}{1+\beta}$*) then the equilibrium strategies are given by*

$$\text{for odd } t,\ s_t^1 = P; \quad \text{and for even } t,\ s_t^2 = \begin{cases} I & \text{if } s_{t-1}^1 = P \\ P & \text{if } s_{t-1}^1 = I \end{cases}$$

Hence, in this case firm 1 always plays P and firm 2 always plays I.

3. *If the consumers' growth parameter is small relative to the fraction of brand 1 oriented consumers but is large relative to the fraction of brand 2 oriented consumers (that is, $\frac{\theta^2}{1+\beta} < \lambda < \frac{\theta^1}{1+\beta}$) then the equilibrium strategies are given by*

$$\text{for odd } t,\ s_t^1 = \begin{cases} I & \text{if } s_{t-1}^2 = P \\ P & \text{if } s_{t-1}^2 = I \end{cases} \qquad \text{and for even } t,\ s_t^2 = P$$

Hence, in this case firm 1 always plays I and firm 2 always plays P.

4. *If the population growth rate is small (i.e., $\lambda < \min\{\frac{\theta^1}{1+\beta}; \frac{\theta^2}{1+\beta}\}$), there are two equilibria: firm 1 always plays P and firm 2 always plays I; and firm 1 always plays I and firm 2 always plays P.*

Figure 1 illustrates the equilibria in the $[\lambda - \theta^1(\theta^2)]$ space.

INSERT FIGURE 1 ABOUT HERE

Figure 1 shows that when the rate of change (increase or decrease) in the number of consumers exceeds a certain level, ($\lambda \geq \frac{1}{1+\beta}$), both firms play P since the profit from attracting the entering consumers exceeds the profit from attracting the old misplaced consumers (by playing I). That is, when $\lambda \geq \frac{1}{1+\beta}$, the entire parameter range (any popularity parameters θ^1, θ^2) generates the unique persuasive advertising equilibrium. In contrast, as the number of entering consumers is declining very fast, there cannot exist an equilibrium where *both* firms use informative advertising.

Figure 1 also reveals (for the case of non increasing consumer population) that when the fraction of brand i oriented consumers is large, $\theta^i > (1+\beta)\lambda$, firm i is better off by playing I, since the profit generated by attracting the (old) brand i oriented (from consuming brand j) exceeds the profit from attracting all the young consumers. In summary, when the consumer population is declining sufficiently fast,

the firm producing the (much) more popular brand will use informative advertising in order to target the experienced users from continuing using the less popular brand.

Finally, part 1 of proposition 1 implies that

Corollary 1 *If the number of entering consumers increases with time ($\lambda \geq 1$) then persuasive advertising constitutes a unique equilibrium.*

Figure 1 also implies that as β increases, the two curves tilt downward. Therefore,

Corollary 2 *An increase in the discount factor β would increase the parameter range where both firms use persuasive advertising.*

That is, an increase in firms' valuation of future profits, implies that more firms would target the young consumers rather than their brand oriented experienced consumers. This result is interesting since it implies that when firms care more about future profits, they would attempt to capture the young consumers since at least a fraction of them would buy the same brand in the subsequent period (which becomes more important as β increases).

3.2 Advertising equilibria under when informative advertising affects inexperienced consumers

We now state the equivalent of Proposition 1 under Assumption 2.[2] A proof is given in the Appendix.

Proposition 2 *1. If $\lambda > \max\{\frac{\theta^1}{\theta^2(1+\beta)}; \frac{\theta^2}{\theta^1(1+\beta)}\}$, then playing $< P, P >$ is a unique equilibrium.*

2. If $\frac{\theta^1}{\theta^2} < \lambda < \frac{\theta^2}{\theta^1(1+\beta)}$, then $< P, I >$ is a unique equilibrium.

3. If $\frac{\theta^2}{\theta^1} < \lambda < \frac{\theta^1}{\theta^2(1+\beta)}$, then $< I, P >$ is a unique equilibrium.

[2]Unlike Proposition 1, to avoid excessive writing we refrain from listing the firms' equilibrium decision rules for this proposition.

4. If $\lambda < \min\left\{\frac{\theta^1}{\theta^2}; \frac{\theta^2}{\theta^1}\right\}$, *then* $< I, I >$ *is a unique equilibrium.*

Figure 2 illustrates the equilibria in the $[\lambda - \theta^1(\theta^2)]$ space.

INSERT FIGURE 2 ABOUT HERE

The small difference between Propositions 1 and 2 is as follows: When informative advertising has some effect on inexperienced consumers (Assumption 2), then when the population is declining sufficiently fast, informative advertising is used by all firms. Obviously, this is never the case when informative advertising does not have an effect on inexperienced consumers. However, disregarding this difference, Propositions 1 and 2 are qualitatively very similar. Both yield that persuasive advertising occurs when the population growth rate exceeds a certain level, and both yield that for moderate population size changes, the more popular brand producing firm would use informative advertising, while the less popular brand producing firm would use persuasive advertising.

4 Collusion and Advertising Agencies

Now suppose that the two firms can coordinate their advertising and share the aggregate industry profit in each period. While industry collusion may be prohibited by anti-trust laws, implicit collusion may occur when the two firms use the same advertising agency that seeks to maximize its share in the aggregate industry profit. From Table 1, we can add the firms' per-period profit. Table 3 provides the per-period industry profit levels.

It is easy to see that the first column in Table 3 is greater or equal than the other three columns for every period t.[3] Thus,

[3]Table 3 is constructed under Assumption 1, however, the same relation should hold under Assumption 2 since the industry's objective is always to maximize the number of consumers purchasing any brand.

Period \ Outcome	$< P, P >$	$< P, I >$	$< I, P >$	$< I, I >$
$\tau - 1$ (even)	$\lambda^{\tau-2}(\lambda+1)$	$\lambda^{\tau-2}$	$\lambda^{\tau-2}(\lambda+1)$	0
τ (odd)	$\lambda^{\tau-1}(\lambda+1)$	$\lambda^{\tau-1}(\lambda+1)$	$\lambda^{\tau-1}$	0
$\tau + 1$ (even)	$\lambda^{\tau}(\lambda+1)$	λ^{τ}	$\lambda^{\tau}(\lambda+1)$	0
$\tau + 2$ (odd)	$\lambda^{\tau+1}(\lambda+1)$	$\lambda^{\tau+1}(\lambda+1)$	$\lambda^{\tau+1}$	0

Table 3: Aggregate Industry Profit Levels, $(\pi_t^1 + \pi_t^2)$, under Assumptions 0 and 1

Proposition 3 *The unique collusive industry outcome is $< P, P >$. That is, a collusive industry would use persuasive advertising and will therefore target new consumers only.*

The intuition behind Proposition 3 is as follows: A profit maximizing colluding industry would simply maximize the number of consumers buying any brand, and will not be concerned with matching consumers with their less preferred brands. For this reason, persuasive advertising is the only optimal method for a collusive industry.

It is natural to ask now whether the collusive outcome can be welfare improving over some non-collusive outcomes. Obviously, the answer depends on the welfare criterion being used, and on consumers' preferences which we actually did not have to fully specify so far. That is, all that was needed to assume so far was that brand i oriented consumers prefer to purchase brand i over j. However, to fully measure the welfare effects of collusion, we need to specify how consumers rank a 'wrong' brand purchase with no purchase at all. Such a specification should depend on the type of product being analyzed, and we therefore omit this analysis.

5 Comparison Advertising

5.1 Comparison advertising: an overview

In the US, no law prevented the use of comparison advertising. However, advertisers were reluctant to use it, Boddewyn and Marton (1978). In the early 70's, television

networks began to (extensively) broadcast comparison advertisements. Since then, comparison ads became popular in the printed media as well.

The *EEC* has also began addressing the issue of comparative advertising in the late 70's, suggesting that comparison advertising should be legal as long as it compares material and verifiable details, and is neither misleading nor unfair.

The principle advantage of comparison advertising is that the information contained in a comparison advertisement provides consumers with low cost means of evaluating available products, Barnes and Blakeney (1982). In addition, comparison ads make the consumers more conscious of their responsibility to compare before buying. It also forces the manufacturer to build consumer wanted attributes into the products and eventually to produce a better product. Obviously, there are arguments suggesting that comparison advertising does not assist consumer comparisons, since the comparison will lack objectivity as the advertiser will select only those aspects of his brand which are superior to those of the competitors. The critics consider that the risk of consumer confusion and deception is great in comparison advertising partly because of information overload.

In most countries where comparative advertising is legal, it is closely monitored and regulated by Federal Trade Commissions (and equivalents). Different studies suggest different figures on the relative use of comparative advertising. Muehling et al. quote that around 40% of all advertising is comparative. Others (Pechmann and Stewart, 1990, and references), suggest that the majority of *all* ads are indirectly comparative (60% vs. 20% which contain direct comparative claims, and the rest are non comparative).

5.2 Strategic use of comparison advertising

The two (slightly differentiated) models of the previous sections can be applied to modeling the strategic use of comparison advertising provided that we make explicit

assumptions about which type of consumers and how do consumers respond to comparison advertising. Assume that each firm has a time independent action set is given by $S \equiv \{A, C\}$, where C means that a firm uses comparison advertising, and A means that the firm advertises its product without comparing it to the competing brand.

Following Assumptions 0 and 1 we assume that

Assumption 3 *1. Plain (non-comparative) advertising (A) attracts only the inexperienced consumers.*

2. Comparison advertising (C) attracts only the experienced consumers who are oriented towards the advertised brand.[4]

Thus, plain (non-comparative) advertising is intended to inform consumers about the existence of the product by informing the consumer about a specific brand. The 'drawback' of plain advertising is that it also attracts new consumers of the wrong type.

In contrast, comparison advertising informs the misplaced consumers (wrong brand users) about the difference between the brand they have purchased in the previous period and their ideal brand. Thus, a firm uses the comparison advertising strategy to attract old users who are oriented towards its brand, but happen to consume the competing brand.

The intuition behind assumption 3 is simple. It is likely that a comparison advertisement is meaningless for the inexperienced consumer simply because a non user may not understand the way the product and its features operate. Thus, a new consumer will not comprehend an ad involving a comparison of the brands' attributes. Assumption 3 suggests that the relevance of comparison advertising is a consequence

[4]Obviously, if we model comparison advertising as an informative advertising according to Assumption 2 (instead of Assumption 1), comparison advertising would attract also inexperienced consumers who are oriented towards the advertised brand.

of prior experience with the product itself. Assumption 3 also suggests that plain advertising is less relevant (irrelevant in our extreme case) to the experienced user, since an experienced user definitely knows about the existence of the product and its basic features.[5]

Applying Proposition 1 to the present case yields

Proposition 4 *1. When the population is increasing with time ($\lambda > 1$), firms do not use comparison advertising. That is, $< A, A >$ is a unique equilibrium.*

2. When the population is declining sufficiently fast, then comparison advertising is used by the more popular brand producing firm. Formally, if $\frac{\theta^2}{1+\beta} < \lambda < \frac{\theta^1}{1+\beta}$ then $s_t^1 = C$ and $s_t^2 = A$.

3. In equilibrium, not all firms undertake comparison advertising.[6]

Note that one of the arguments for allowing comparison advertising is that it enables a relatively unknown small firm to attract consumers' attention by making a reference to a well known brand producing firm. However, Proposition 4 (item 2) shows that then it is the more popular brand producing firm that would use comparison advertising. The reason for this is that the firm producing the more popular brand would have a greater incentive to compare its brand's attributes with the attributes of the less popular brand.

6 Concluding Remarks

The paper proposes a method for endogenizing firms' decision on which advertising method to use when the consumer population size increases or decreases. The paper

[5]While assumption 3 sounds very intuitive, to my best knowledge it has not been tested. In fact, many experiments cited in the references (e.g., Chapter 7 of Boddewyn and Marton) tend to find a very little difference in the effects produced by comparative and non comparative advertising. However, none of these tests attempted to test it on experienced and first time buyers separately.

[6]This statement does not hold under Assumption 2.

shows that: (a) Persuasive advertising is likely to be used by all firms when the (potential) consumer population is increasing or moderately decreasing. (b) Informative advertising may be used by all firms only when the consumer population is declining sufficiently fast. (c) The more popular brand is likely to be informatively advertised, while the less popular brand is likely to be persuasively advertised. (d) Colluding firms would always use persuasive advertising.

The model introduced in this paper can be modified to analyze how political parties choose their agendas when facing a changing voter population. Consider a two party electoral system where each political party chooses an agenda appealing to a fraction of the population (for example, young or old). There are two ways of thinking about the objective of the parties. The present model can be applied to modeling a political voting if parties are concerned with the number of seats in the parliament each period, which is proportional to the number of old and young voters who vote each period according to the advertised agendas. However, note that the present model is not applicable to political voting if the parties' objective is to win the election (that is, if the parties only care whether the get a majority or not).

Assuming that the objective of each party is to maximize the number of voters, with some change of notation we can apply Propositions 1 and 2 to ask what kind of agendas parties will adopt when facing variable voter population size. Clearly, if the population is increasing, then both parties will adopt agendas favored by the young regardless of the young's political orientation, (similar to the median voter agenda proposed in Downs (1957)). However, if the voter population is declining, the political parties will adopt 'left' or 'right' agendas according to the distribution of voters' tastes. That is, one party would adopt the more popular agenda, while the other would either adopt the opposing agenda, or will adopt agenda appealing to an age group.

Appendix

Proof of Proposition 1: Following Maskin and Tirole (1987) and (1988), it is sufficient to show that one period deviation is not profitable.
Part 1: In the $< P, P >$ equilibrium, for every odd t

$$PV_t^1(P,P) = \lambda^t + \beta\lambda^t + \beta^2 PV_{t+2}^1(P,P)$$

Now, if in some odd period τ firm 1 deviates and plays I,

$$PV_\tau^1(I,P) = \theta^1\lambda^{\tau-1} + \beta 0 + \beta^2 PV_{t+2}^1(P,P)$$

It can be easily verified that deviation is not profitable if $\lambda > \frac{\theta^1}{1+\beta}$. Similarly, it can be shown that in every even period t, firm 2 will not deviate if $\lambda > \frac{\theta^2}{1+\beta}$.
Part 2: If Firm 1 always plays P and firm 2 always plays I, in every odd period t,

$$PV_t^1(P,I) = \lambda^t + \lambda^{t-1} + \beta\theta^1\lambda^t + \beta^2 PV_{t+2}^1(P,I)$$

However, if in some even period τ firm 1 deviates and plays I then,

$$PV_\tau^1(I,I) = 0 + \beta 0 + \beta^2 PV_{\tau+2}^1(P,I)$$

Hence, firm 1 will not deviate.

To show that firm 2 does not deviate observe that in even period t

$$PV_t^2(P,I) = \theta^2\lambda^{t-1} + \beta 0 + \beta^2 PV_{t+2}^2(P,I)$$

However, if for some even period τ firm 2 deviates and plays P then,

$$PV_\tau^2(P,P) = \lambda^\tau + \beta\lambda^\tau + \beta^2 PV_{\tau+2}^2(P,I)$$

It can be easily verified that firm 2 does not deviate in some even τ if $\lambda < \frac{\theta^2}{1+\beta}$.

Part (3) is the polar case of (2). Part (4) follows immediately.

Finally, uniqueness of parts (1)-(3) follows from the fact that the regions in the parameter space (Figure 1) defined by the conditions in the proposition do not overlap one with another. *Q.E.D.*

Proof of Proposition 2: To prove (1), note that $PV_t^1(P,P) = \lambda^t + \beta\lambda^t + \beta^2 PV_{t+2}^1(P,P)$, and $PV_t^1(I,P) = \theta^1(\lambda^{t-1} + \lambda^t) + \beta\theta^1\lambda^t + \beta^2 PV_{t+2}^1(P,P)$.

Hence, one period deviation will not occur when

$PV_t^1(P,P) > PV_t^1(I,P)$ if $\lambda > \frac{\theta^1}{(1-\theta^1)(1+\beta)}$.

Similarly, $PV_t^2(P,P) > PV_t^2(P,I)$ if $\lambda > \frac{\theta^2}{(1-\theta^2)(1+\beta)}$.

To prove (4), note that $PV_t^1(I,I) = \theta^1(\lambda^{t-1} + \lambda^t) + \beta\theta^1\lambda^t + \beta^2 PV_{t+2}^1(I,I)$, and $PV_t^1(P,I) = \lambda^t + \beta\theta^1\lambda^t + \beta^2 PV_{t+2}^1(I,I)$. Now, $PV_t^1(I,I) > PV_t^1(P,I)$ if $\lambda < \frac{\theta^1}{\theta^2}$.

Similarly, $PV_t^2(I,I) > PV_t^2(I,P)$ if $\lambda < \frac{\theta^2}{\theta^1}$.

Altogether, $< I, I >$ is an equilibrium if $\lambda < \min\left\{\frac{\theta^1}{\theta^2}; \frac{\theta^2}{\theta^1}\right\}$.

To prove (2), note that $PV_t^2(P,I) = \theta^1(\lambda^{t-1} + \lambda^t) + \beta\theta^2\lambda^t + \beta^2 PV_{t+2}^2(P,I)$, and $PV_t^2(P,P) = \lambda^t + \beta\lambda^t + \beta^2 PV_{t+2}^2(P,I)$.

Now, $PV_t^2(P,I) > PV_t^2(P,P)$ if $\lambda < \frac{\theta^2}{(1-\theta^2)(1+\beta)}$.

By part (4), $PV_t^1(P,I) > PV_t^1(I,I)$ if $\lambda > \frac{\theta^1}{\theta^2}$.

Finally, uniqueness follows by the same argument given in Proposition 1. *Q.E.D*

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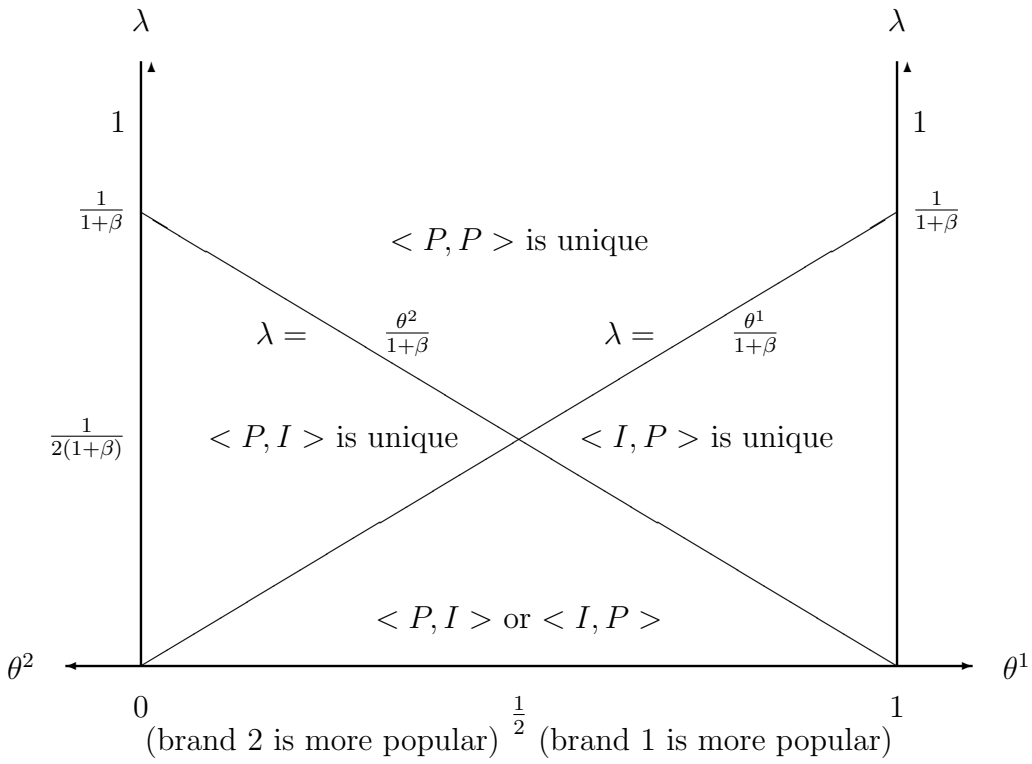

Figure 1: Advertising methods equilibria under Assumptions 0 and 1

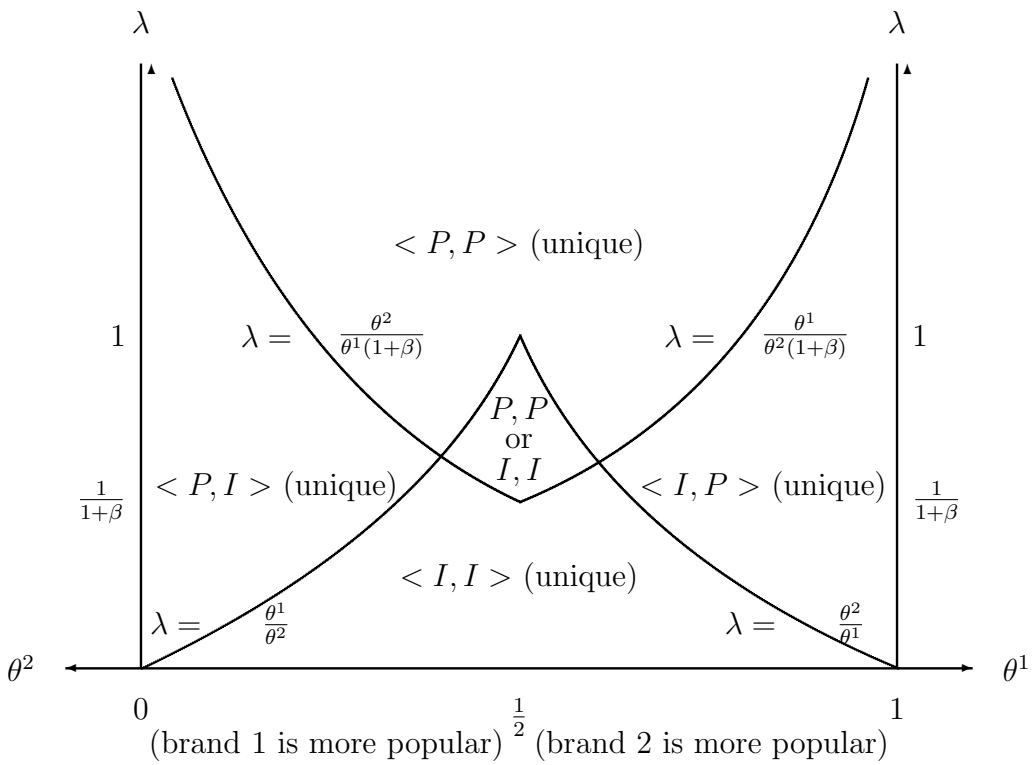

Figure 2: Advertising methods equilibria under Assumptions 0 and 2