



Informative advertising in differentiated oligopoly markets[☆]

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ABSTRACT

This paper examines the welfare implications of informative advertising in differentiated product oligopoly markets. The analysis reconciles the conflicting results in previous studies that find advertising to be undersupplied in homogeneous product markets, but oversupplied in differentiated product markets when the degree of differentiation is “small”. In equilibrium, purely informative advertising is undersupplied when brands are sufficiently close substitutes and oversupplied when brands are more differentiated. Product differentiation also has welfare implications for the effect of technological change in the advertising sector. In response to an advertising cost innovation, equilibrium prices fall and the market converges to the socially optimal resource allocation for brands that are sufficiently close substitutes, whereas equilibrium prices rise and divergence occurs when brands are more differentiated.

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1. Introduction

An important role of advertising is to provide consumers with factual information about product attributes. Advertising that informs consumers about product specifications benefits society both by stimulating the exchange of products to new customers and by facilitating better matches between existing customers and brands. But advertising is also a costly activity, for instance annual advertising expenditures in the U.S. represent approximately 2.3% of GDP (Advertising Age), and delivering informative advertisements to consumers who are already informed about products is a socially wasteful activity.

This paper addresses the efficiency of informative advertising outcomes in oligopoly markets. Social and private advertising incentives differ in the model due to three external effects, the relative importance of which depends on how the value of information is capitalized among “new” and “existing” customers in the market. Informative advertising that reaches new consumers embodies an externality familiar to search goods: The cost of search is borne entirely by the searcher, while the benefits are divided between the searcher and the agent with whom she trades. This *market size effect* causes advertising to be undersupplied in the market equilibrium. Informative advertising that reaches existing consumers of a rival brand potentially improves the matches between consumers and brands, thereby raising consumer utility. Because advertising firms are

unable to fully appropriate these rents, this *matching effect* also causes advertising to be undersupplied in the market equilibrium. But informative advertising by one brand that reaches existing consumers of a rival brand also serves to attract customers away from rivals, an activity that is less valuable to society than to individual firms. This *business-stealing effect* causes advertising to be oversupplied in the market equilibrium.

The analysis is framed by a differentiated-product oligopoly model with imperfect information. Consumers have heterogeneous tastes for product attributes, but are unaware of the attributes contained in individual brands without receiving an advertisement from that brand. The role of advertising is to convey factual information to consumers about the prices and product specifications of the advertised brand. Grossman and Shapiro (1984) (henceforth GS) employ this framework to compare private and social advertising outcomes in a model with highly substitutable brands. GS demonstrate that advertising decreases equilibrium prices and that the market level of advertising exceeds the socially optimal level of advertising when the brands are sufficiently close substitutes. Soberman (2004) extends this model to show that the equilibrium price is increasing in the level of advertising for more differentiated brands, but does not examine welfare implications as done here.

The basic message of this paper is that the efficiency of markets for purely informative advertising depends on the extent of product differentiation in the industry. The reason is that the market size effect and the matching effect decrease with the degree of product differentiation in the market, while the business-stealing effect increases (up to the limit of oligopoly interaction in the market). For highly substitutable products, informative advertising produces relatively large market size effects and negligible business-stealing effects. Advertising, accordingly, is undersupplied. For more

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differentiated goods, the business-stealing effect dominates the combined influence of the market size and matching effects, and advertising is oversupplied. However, for still more differentiated products, local monopoly markets emerge: The business-stealing externality vanishes, and advertising is again undersupplied.

The analysis reconciles some conflicting results in the advertising literature. In particular, the welfare implications of informative advertising under differentiated, but highly substitutable brands in GS contrasts with the welfare implications that emerge in models with homogenous goods. Stegeman (1991) and Stahl (1994) show that purely informative advertising exists only in mixed strategies and is always undersupplied under price competition, and Gary-Bobo and Michel (1991) find that advertising does not occur at all as the number of firms becomes large under quantity competition.¹ This distinction turns out to arise from the use of the “large group” assumption of Dixit and Stiglitz (1977) in differentiated product models. The present paper removes this assumption and demonstrates that advertising is always undersupplied (in pure strategies) below a critical level of product differentiation.

The paper also numerically examines the welfare implications of technological change in the advertising sector. Technological change is important in advertising markets, as the emergence of new media, for instance digital platforms and content networking on the internet, can reduce the cost of achieving a given reach of an ad campaign. In response to an advertising cost innovation, advertising frequencies rise, and this produces welfare implications that depend on the extent of product differentiation in the market. For highly substitutable products, greater advertising frequencies increase demand elasticities (and reduce prices), and the market equilibrium converges to the social optimum. For highly differentiated products, greater advertising frequencies decrease demand elasticities and raise equilibrium prices. A reduction in advertising cost exacerbates both advertising and price distortions in the market, and the market equilibrium diverges from the social optimum.

The remainder of the paper is structured as follows. The next section describes consumer demand for differentiated products. Section 3 derives market equilibria under local monopoly and two types of oligopoly that emerge according to whether or not advertisements received by consumers who are already aware of the rival brand create new consumption units. Section 4 calculates the socially optimal advertising allocation and presents a comparison of optimal and market advertising levels, with numerical analysis provided to support the main results.

2. Informative advertising and consumer demand

Consider a duopolistic industry in which firms sell differentiated brands to consumers. Each consumer is atomistic and has unit demand. Consumers rely on information received from advertisements to locate specific brands in the product space and do not engage in any activities to acquire information other than by viewing ads. The advertisements are truthful and convey information about the existence of products and the attributes contained in each brand.

Brands in the model differ according to their characteristics in the sense of Lancaster (1975). The role of advertising is to match consumers to the products that best suit their tastes. This demand structure is represented by a Hotelling (1929) “linear city”, in which consumers are identified according to points on a line segment that correspond to their ideal product characteristics.² Firms are located at

the endpoints of the line segment and consumers are distributed uniformly with unit density over the interval.

Each consumer purchases at most one unit and receives a gross value of v from consuming the product. Consumers incur transportation costs of t per unit of distance, so that the net surplus enjoyed by a consumer who purchases a brand a distance x units away at a price of p is $v - p - tx$. Consumers purchase the product only if they are aware of a brand in the product category that offers positive net surplus, and a consumer who is aware of both brands selects the brand that provides the highest net surplus.

Following Butters (1977), the advertising process is specified by assuming firms send independent advertising messages and have no ability to target advertisements towards consumers located at particular points in the product space.³ Let ϕ_i denote the advertising intensity of firm i . Advertising intensity is measured in terms of the reach of the ad campaign, so that ϕ_i is interpreted as the fraction of the consumer population that is exposed, at least once, to the advertising message of firm i . This divides consumers at each location in the product space into four types: With probability $\phi_i\phi_j$, $j \neq i$, a consumer simultaneously receives advertising messages from both brands; with probability $\phi_i(1 - \phi_j)$ a consumer receives an ad from brand i but not from brand j ; with probability $(1 - \phi_i)\phi_j$ a consumer receives an ad from brand j but not from brand i ; and with probability $(1 - \phi_i)(1 - \phi_j)$ a consumer fails to receive any advertising message at all. Aggregate demand facing each firm sums the demand functions among consumers of each type.

The market equilibrium studied is the symmetric, non-cooperative Nash equilibrium in prices (p) and advertising intensities (ϕ). There are four types of market equilibrium. First, there are mixed strategy equilibria: For various levels of product differentiation these are the only equilibria that exist. Apart from the regions that contain only mixed strategy equilibria, a monopoly region and two oligopoly regions emerge that support symmetric, pure strategy Nash equilibria. If the market prices are set at a level that a fully-informed consumer located at the midpoint of the segment buys neither brand (i.e., demand regions do not “overlap”), a local monopoly equilibrium emerges. If all fully-informed consumers make a purchase at the prevailing market prices, the type of oligopoly equilibrium that emerges depends on whether prices are set at a level that also induces all partially informed consumers to purchase the brand. Partially-informed consumers travel farther (on average) than fully-informed consumers in the market, because imperfect information can lead to inferior matches between consumers and brands. The market is described hereafter to be “completely covered” if all consumers who receive at least one advertising message purchase a brand at prevailing prices, $t \leq (v - p)$; and the market is described to be “incompletely covered” if at least one partially informed consumer does not make a purchase at prevailing prices: $t/2 \leq (v - p) < t$.

GS consider the case of complete coverage. The equilibrium prices in their model are assumed to be sufficiently low that all consumers receiving an advertising message purchase the product, even if doing so requires traveling the entire length of the line segment. Under incomplete coverage, the equilibrium prices are low enough that a fully informed consumer located at the midpoint of the line segment purchases the product, $v - p \geq t/2$, but high enough that a partially informed consumer located at the endpoint of the line finds it prohibitively costly to travel the entire length of the line segment to purchase the more distant brand, $v - p < t$.

Among the fully informed population of consumers, let $x_i^j(p_i, p_j)$ denote the distance from firm i to the consumer who is indifferent

¹ In Gary-Bobo and Michel (1991), advertising is a collective good that shifts the demand of all firms. Their results are in accordance with the general outcome of oligopoly models when firms invest in a collective good.

² The merit of this approach over a Salop (1979) circular city model is its simplicity, and the two models produce qualitatively similar results in settings without entry.

³ For an analysis of the case of targeted advertising, see Iyer, Soberman, and Villas-Boas (2005).

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