How Sponsored Search Advertisements Impact Consumer Prices

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Whether online advertising improves consumer welfare depends, in part, on the effect that advertising has on the prices consumer will pay for advertised products. To date, however, little empirical research has studied the impact of online advertising on consumer prices. In our ongoing study, we mine price and advertising data for a large sample of products sold online using a popular search engine, and investigate the relationship between sponsored search advertisements and consumer prices across those products.

The impact of advertising on consumer welfare (and, in particular, the price consumers pay for products) has been a disputed subject among economists. Pigou looked favorably at what he called "informative" advertising (advertising that makes an unknown product or characteristic known) but regarded "competitive" advertising (advertising that tries to lure people away from a competing product without providing valuable information) as an evil that should be avoided (Pigou, 1932). Since Pigou's days, both "informative" and the "competitive" views have become popular in the economic literature on advertising and have provided alternative predictions on the relationships between advertising, consumer welfare, and consumer prices. The informative view of advertising posits that, as advertising provides product information that would otherwise

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be unknown to the consumer, it reduces search costs and increases competition, reducing prices and increasing consumer welfare (Nelson, 1974). The second ("competitive") view, instead, argues that advertising is used for persuasion, making consumers prefer heavily advertised brands to potentially lower cost alternatives, increasing the latter's market power (Comanor and Wilson, 1979; Nichols, 1985; Dixit and Norman, 1978). This means that advertising can lower the demand elasticity and increase prices of advertised products. The increase in prices translates into a loss of surplus by consumers and a decrease in social welfare.

Both views of advertising have found support in theoretical and empirical works. While some scholars have supported the persuasive view (Alston, Chalfant and Piggott, 1999; Krishnamurthi and Raj, 1985; Boulding, Lee and Staelin, 1994), others have backed the informative view (Mitra and Lynch, 1996; Ackerberg, 2001; Benham, 1972). Others still have recognized that both effects may be simultaneously at play. Becker and Murphy (1993) suggested whether advertising has positive or negative impacts on consumer welfare depends on a variety of factors (e.g. the extent to which advertising influences price and output of advertised goods), and Ackerberg (2001) highlighted both a "prestige" and "informative" effects of advertising.

Most of the aforementioned work, however, has focused on offline mechanisms of advertising. Arguably, the welfare implications of advertising have been impacted by the targeting of ads made possible by information-rich digital environments. A growing stream of theoretical work has started considering the welfare implications of online targeted advertising. Johnson proposes a model in which consumers benefit from the improved relevancy of the ads but are negatively affected by increased volume (Johnson, 2013). Anand and Shachar suggest that by using targeted advertising as a signal, targeted ads may convey beneficial information to consumers (Anand and Shachar, 2009). Iyer, Soberman and Villas Boas propose that by

identifying comparison shoppers, targeted advertising can be used to persuade them to buy a company's product rather than the competitors' (Iyer, Soberman and Villas-Boas, 2005). These diverse papers collectively suggest that the addition of targeting brings additional complexities to the impact of advertising on prices consumers face and, by extension, their welfare.

In our study, we focus on sponsored search advertising where ads are targeted to match key search terms entered on search engines. To our knowledge, there is limited empirical research on the impact that this type of targeted advertising has on the prices consumers will pay for advertised vs. non-advertised products. Ghose and Yang modeled consumer click-through and conversion rates based on searched keywords (Ghose and Yang, 2009) and identified interdependence of organic and advertised search results (Yang and Ghose, 2010). Regarding the impact of sponsored search on consumer welfare, Athey and Ellison developed a theoretical equilibrium model based in customer search costs and firms bidding strategies (Athey and Ellison, 2011). Animesh, Ramachandran and Viswanathan show that in a pure market bidding for ads where quality uncertainty is high, lower quality vendors might position themselves higher, negatively affecting consumer welfare; the opposite is true when search engines consider performance and quality factors in the bidding process (Animesh, Ramachandran and Viswanathan, 2010). Yao and Mela show with a dynamic structural model the existence of a positive relation between quality, price and sponsored search position (Yao and Mela, 2009). However, their data was limited to a very narrow product category. Mining price and advertising data across a large sample of product searches among a broad range of product categories, we aim at determining how targeted advertising may impact prices that consumers face for products, and therefore their welfare as well, in a more general manner.

Data collection procedure

The main objective of our study is to use data from a large sample of product searches to compare prices displayed for products in organic (non-paid) results versus the prices displayed for products in sponsored search results. The study consists of two phases: selection of products (which has been nearly completed) and price collection (which is in the pilot stage).

In the first phase, we aimed at obtaining a representative set of products to use in the data collection phase. For this process, we leveraged the product categories of three large online vendors (Amazon, Walmart and Target) and organized product using three levels: category, subcategory and product type. An example of this classification would be as follows: category "Electronics", subcategory "Audio and Video" and product type "Smart TV". Using a set of selection criteria we obtained 805 product types among 209 subcategories and 10 categories. We are now in the process of selecting the representative sample of 1,000 product models. To avoid confusion, we refer to specific products within a product type (for example: a Sony 49-Inch 4K Ultra HD Smart LED TV with model number "KD49X720E") as a "product model".

Once the product models are selected, data on each of the products is going to be collected. We will perform the searches for the products on the google search engine and take note of the results that are shown in the first two pages. For each product model, we will perform a search using a popular search engine and obtain the vendor name, price, additional costs (such as shipping or oversize fees), source (sponsored search or organic search results), as well as additional details such as time of day, exact order of appearance, review scores of the product, and page number in which the result appeared. We will supplement this data with secondary databases to capture information about the product (e.g. consumer ratings of the product model)

as well as the vendor selling the product model. Figure I shows the basic schema of the search results.

Various popular search engines allow the targeting of sponsored search results (for instance, Google uses keywords, time of day, location and language, device and audience; Google, 2017). The keywords will correspond to a unique way of identifying each product, allowing us to obtain ads for the desired product. We plan to perform searches at different times of the day and days of the week. Location and language are determined by search engines based on IP addresses. So as not to bias results towards products in a specific market, we will be using VPN servers located throughout different locations the U.S. To capture mobile as well as desktop ads, we will use synthetic browser profiles. Search engines use cookies to target specific audiences. Specifically, sellers may change their biddings of ads in search results based on whether a user has previously visited the seller's website. This means that if a website is visited during the search of product X, the bids of that specific website may change when doing searches for product B. As this may introduce bias into our data collection effort, we will clear all cookies after each search.

Expected analysis and implications

Our analysis will focus on possible price differences between sponsored and organic search results. We expect that this analysis may provide some insight over the impact that these forms of online targeted advertising can have on consumer prices and consumer welfare. As noted, one argument in the economic debate over advertising is that ads increase competition and lower prices for products. By comparing prices from ads and organic results for the same products, and by controlling for sellers' characteristics, we aim at investigating the extent to which users get favorable offers from the advertisements shown or if they are rather better off by going through the search results. Moreover, whether prices differ between sponsored and organic search results

may depend on the features of the both the vendor and product. As a result, we also plan to evaluate these effects across variation in product quality, high vs. low end products, type and size of vendor, and so forth. We also intend to estimate the time a user would take to find a better result than the ones shown in the ads, by considering the position of the results. This will allow us to compare price differentials across advertised and non-advertised products to changes in search costs that may offset those differentials.

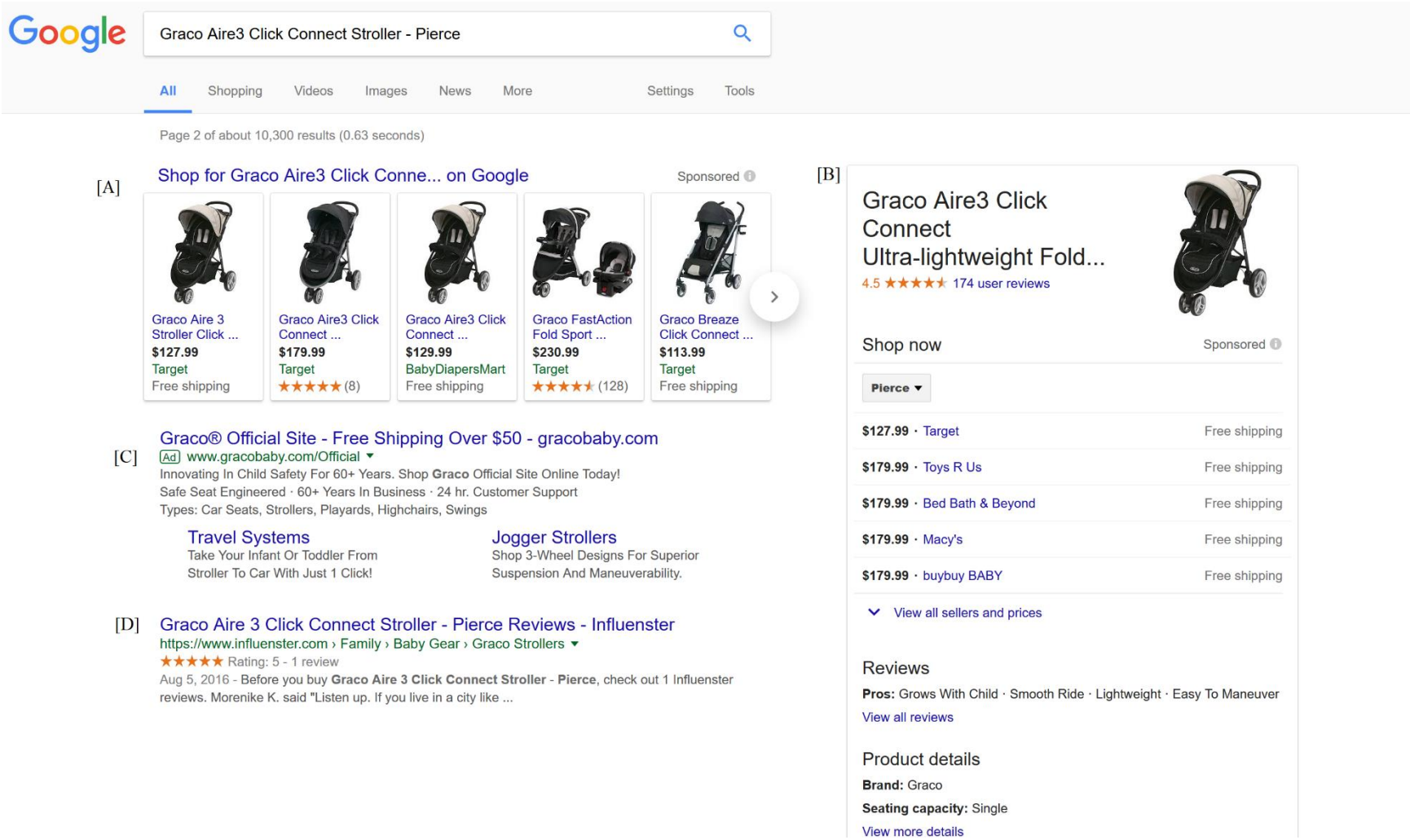

Figure 1: Basic schematics of a results page. [A] Shows sponsored results tiles, which can have a different product model in each tile and can appear in the top, bottom or right side of the page. [B] Shows a sponsored result sidebar, which shows different vendors for the same exact product model. [C] Shows a sponsored inline result, which looks very similar to organic (unpaid) results but has a green "Ad" indicator, and can appear either before or after organic search results in each page. [D] Shows an example of an organic search result. Organic results can lead to vendors, product listings videos, reviews, among others, and so it does not always lead to a page in which the product can be bought.

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