



The order effect of advertisers on consumer search behavior in sponsored search markets



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ABSTRACT

This research examines consumer search behavior across multiple ordered advertisers in sponsored search markets. To consider the sequential nature of consumer search, we model search behavior as a set of inter-dependent ordered decisions: namely, the entry, click, and stop decisions. Using individual-level data obtained from a search engine, we identify the key determinants of consumer search behavior in the sponsored section of search results. Our results reveal that there is significant variation in the effects of advertisers' latent brand equity and website quality on the search decisions. Thereby, search behavior heavily depends on the ordered composition of advertisers in sponsored listing. We highlight the ability of our model to quantify the order effect of advertisers on the number of clicks on sponsored ads, which can assist the search engine and advertisers in predicting the click counts and assessing the value of ad positions.

1. Introduction

Sponsored search advertising – where advertisers buy ad positions for specific keywords to display their ads alongside organic search results by Internet search engines – has grown into a prominent form of online advertising. Firms have been actively adopting this advertising method as it enables them to efficiently deliver targeted advertising messages to online consumers who seek specific products or services. Major search engines (e.g., Google, Bing, Yahoo) now offer multiple ad positions in their sponsored section of search results. In 2016, sponsored search advertising accounted for more than 40% of the total US online ad spending, estimated to be \$67 billion, and is predicted to grow at an annual compound rate of at least 10% over the next three years (eMarketer, 2016).

Given the phenomenal popularity of sponsored search advertising, several researchers have examined consumers' click behavior on sponsored links and identified key factors, such as keyword characteristics, ad positions, and selling propositions, that affect the click-through or conversion rates (e.g., Ghose & Yang, 2009; Agarwal, Hosanagar, & Smith, 2011; Animesh, Viswanathan, & Agarwal, 2011). Yet, as the majority of earlier studies use data which pertain to a single advertiser and/or are aggregated across consumers, limited research considers how individual consumers respond to a set of competing advertisers displayed together in sponsored listing. In this research, we study individual-level search behavior across advertisers, using unique search instance-level data obtained from a search engine.

In sponsored search advertising, ad positions are sold to advertisers typically via auctions managed by a search engine. The advertisers' positions are then adjusted based on their bid and quality score assessed by the search engine's proprietary algorithms (Abou Nabout & Skiera, 2012). Upon winning an ad position, advertisers appear in a “vertically” ordered listing in response to consumers' keyword search. This ordered listing of advertisers creates a directional market in which consumers navigate and process the ads sequentially in the order they are listed (Arbatskaya, 2007; Animesh et al., 2011). As a result, advertisers listed in the top positions tend to attract more clicks than others in lower positions (e.g. Agarwal et al., 2011), suggesting that the position of advertisers serves as an important determinant of click behavior. In the same position, however, different advertisers may garner different numbers of clicks because of the disparities in their brand equity and attractiveness to consumers. Another important dimension of advertiser characteristics which may influence search behavior is the quality of advertisers' landing pages. After a consumer clicks an ad link and thereby visits the advertiser's website, the consumer's decision on whether to navigate the remaining ads in the sponsored section may depend on her satisfaction with the information obtained at the website visited. Accordingly, if advertisers with strong brand equity and high-quality landing pages occupy the top positions in sponsored listing, consumers may be less likely to process ads in lower positions.

As such, because advertisers often differ from each other in both their brand equity and website quality, consumers' search behavior in sponsored listing is likely to be influenced by not only the combination

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Table 1
Overview of selected empirical studies on consumer search behavior in sponsored search advertising.

Authors	Data characteristics			Main focus
	Aggregate level	Individual level	Multiple advertisers	
Ghose and Yang (2009)	✓			Factors that affect the click-through rate conversion rate, and rank position of advertisers
Yang and Ghose (2010)	✓			Relationships of organic and sponsored search results in their click-through and conversion rates
Agarwal et al. (2011)	✓			The effect of ad positions on the click-through and conversion rates
Animesh et al. (2011)	✓			The effect of unique selling propositions on the click-through rate
Rutz and Bucklin (2011)	✓			The spillover effect of generic keyword search on branded keyword search
Abou Nabout and Skiera (2012)	✓			The effect of ad quality on search engine marketing costs and profits
Yang et al. (2014)	✓		✓	The effect of advertiser competition on click volume and cost per click
Chan and Park (2015)		✓	✓	The interactive effect of forward-looking search activity and advertiser competition
This study		✓	✓	The order effect of advertisers on search behavior and click volume across ads

but also the competitive order of advertisers listed together. To take this sequential dependency into account, we develop a statistical model that characterizes a consumer's search behavior as a combination of three stylized decisions: namely, the entry, click, and stop decisions. The entry decision refers to a consumer's decision on whether to navigate to the sponsored listing of advertisers, when the organic and sponsored search results are presented to the consumer in response to her keyword query. If the consumer decides to navigate to the sponsored listing, then she further makes two interdependent search decisions for each sponsored ad. The click decision refers to her decision on whether to click the ad link and the stop decision refers to her decision on whether to stop the search after clicking the link and visiting the associated advertiser's website. We then model consumer search behavior as a set of interdependent ordered events that arise as the outcome of these three search decisions. Because the outcomes of the decisions are partially observed, we take a probabilistic approach to modeling the behavior.

We apply our model to data from a major search engine in Asia. The data include search instance-level information about all competing advertisers that appeared in sponsored listing in response to a consumer's search query, and which sponsored ads she clicked. Analyzing the data, we identify a number of key factors that affect consumers' search behavior in sponsored search markets. Importantly, in addition to the effects of advertisers' position and selling proposition, which is also documented in the literature (e.g., Ghose & Yang, 2009; Agarwal et al., 2011), we find that there is significant variation in the advertiser-specific effects with respect to the two aforementioned essential latent characteristics of advertisers: brand equity and website quality. This implies that consumers' search behavior in sponsored listing can heavily depend on the ordered composition of advertisers displayed together. Accordingly, for an advertiser, not only its own ad position but also the identify and position of competing others are a critical determinant of consumer click on the ad link.

Based on the estimation results, we conduct simulation studies in which we demonstrate the ability of our model to quantify the order effect of advertisers on the number of clicks on sponsored ads. Accurate predictions of the click counts are critical to both the search engine and advertisers because their revenues are closely correlated with the click volume on sponsored ads. Along this line, the simulation results are useful to the search engine in developing the revenue-maximizing ranking scheme of ads (e.g., Weber & Zheng, 2007; Ghose, Ipeirotis, & Li, 2012). We find that, depending on the order of advertisers, the search engine can garner up to 11% more clicks with the same set of advertisers. The results can also help the search engine and advertisers

better assess the value of an ad position by taking the relative positions of competing ads into account, which in turn can assist them in managing and utilizing auctions, respectively.

The remainder of this article is organized as follows. In Section 2, we provide an overview of prior literature related to our work and discuss the contribution of the research to the literature. Section 3 describes the data used in our empirical analysis. Section 4 provides a formal specification of our model. In Section 5, we discuss model results and their implications for the search engine and advertisers. Finally, Section 6 concludes and suggests future research directions.

2. Related literature

The popularity and commercial success of sponsored search advertising has motivated substantial research on it. Empirical researchers have uncovered various new insights about consumer behavior in sponsored search markets such as the effects of keyword characteristics, ad positions, and selling propositions on the click-through and/or conversion rates (e.g., Ghose & Yang, 2009; Agarwal et al., 2011), search activity between organic and sponsored listings (e.g., Yang & Ghose, 2010), spillover effects across related keywords (e.g., Rutz & Bucklin, 2011), the effect of ad quality on search engine marketing costs and profits (e.g., Abou Nabout & Skiera, 2012), the effect of advertiser competition on click volume and advertising costs (e.g., Yang, Lu, & Lu, 2014). Table 1 provides an overview of selected previous studies on sponsored search advertising, in comparison to ours.

While prior studies shed light on our understanding of sponsored search markets, the majority of them use data which pertain to a single advertiser and/or are aggregated at the daily or weekly level. Accordingly, there has been scant research on individual-level search behavior across multiple advertisers. Abhishek, Hosanagar, and Fader (2015) discussed a critical bias in model estimates that can arise from using aggregate-level click data. Recently, Chan and Park (2015) investigated the interactive effect of search behavior and advertiser competition on the value of ad positions, using individual-level search data on multiple advertisers.

Our research differs substantively from Chan and Park (2015), as well as other previous studies, in that our focus is on examining and quantifying how the ordered composition of advertisers would affect consumers' search behavior and click volume across ads — a new addition to the literature. The two studies also differ in terms of their modeling approach. Built on the sequential search framework in the economics literature (e.g., McCall, 1970), Chan and Park (2015) assume

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