Decision Support Systems 52 (2011) 1–8

Contents lists available at ScienceDirect

Decision Support Systems

journal homepage: www.elsevier.com/locate/dss

Online keyword based advertising: Impact of ad impressions on own-channel and cross-channel click-through rates

Ram Gopal[1], Xinxin Li[2], Ramesh Sankaranarayanan *

Operations and Information Management, 2100 Hillside Road, U-1041, Storrs, CT 06269, United States

ARTICLE INFO

Article history:
Received 25 February 2010
Received in revised form 8 March 2011
Accepted 11 April 2011
Available online 19 April 2011

Keywords:
Online keyword-based advertising
Channel cannibalization
Within-channel decreasing returns to impressions

ABSTRACT

Keyword-based ads are becoming the dominant form of advertising online as they enable customization and tailoring of messages relevant to potential consumers. Two prominent channels within this sphere are the search channel and the content channel. We empirically examine the interaction between these two channels. Our results indicate significant cannibalization across the two channels as well as significant diminishing returns to impressions within each channel. This suggests that under certain conditions both channels may need to be used to optimize returns to advertising both for advertisers and service providers such as Google. Our game theoretic analysis which builds upon our empirical findings reveals that for intermediate budget values it is optimal to use both channels whereas for very low (very high) budget values it is optimal to use only the content (search) channel. Further as budget increases the advertiser should offer more for ads displayed on the search channel to optimally incentivize the service provider.

© 2011 Elsevier B.V. All rights reserved.

1. Introduction

Online advertising is becoming increasingly prominent. According to eMarketer, a leading online market research company, an estimated $22.37 billion was spent on online advertising of various forms in 2009, of which $10.78 billion was spent on keyword based ads (primarily through search engines). Several different formats of online advertising have been tried out, including keyword-based ads (with a 2009 market share of 48%, according to eMarketer), banner ads (21%), classifieds (10%), lead generation (7%), rich media (7%), video ads (5%), and email based ads (1%). Google is estimated to control about 70% of the online advertising market, according to Browser Media, a UK-based Search Engine Marketing agency. Clearly, keyword-based advertising has come to dominate this landscape. Within keyword-based advertising, two distinct channels have emerged — search channel and content channel.

Ads on the search channel are displayed alongside search results, in response to the search keywords entered by the user. Ads on the content channel are displayed on a page containing content that is relevant to ads. The decision to show an ad on a content page is determined by the relevance of the ad to the content on the page. Search based advertising can be viewed as the more “active” of the two channels, because the user enters specific keywords that they are searching for information about. However, the philosophy behind both channels is the same — the focus is on trying to serve relevant ads based on an accurate determination of the user's interest, either through keywords that the user enters (in the case of search channel), or through the nature of the content-website the user visits (in the case of content channel).

There are two main reasons why keyword-based ads have come to dominate online advertising — better targeting of customers and better measurability. First, service providers such as Google are successful at targeting such ads at the right audience at the right time, and in aligning users' interests with relevant ads. Second, the business model for keyword-based ads marks a radical departure from previous ad-business models, in that advertisers pay only when a user clicks on an ad (at a cost per click (CPC) that is set by the advertiser), instead of merely when an ad impression is served. An advertisement's main purpose is to bring a product or service to the attention of a potential customer. A user's clicking of an ad impression is a better indicator that this purpose is served, compared to the mere serving of an ad impression.

Google is the dominant company in keyword-based advertising. Google's share of US paid search advertising in 2009 is estimated at 70% of a $10.8 billion spend, according to eMarketer (David Hallerman, January 27, 2010). Almost 100% of Google's revenue is derived from keyword-based advertising (as per Google's annual report). Google serves keyword-based ads through both search and content channels. Google's data on search keyword based advertising has spawned an active stream of prior research that has looked at a variety of questions pertaining to bidding strategies, pricing of keyword slots,

---

* Corresponding author. Tel.: +1 860 486 5217.
E-mail addresses: Ram.Gopal@business.uconn.edu (R. Gopal), Xinxin.Li@business.uconn.edu (X. Li), rsankaran@business.uconn.edu (R. Sankaranarayanan).
[1] Tel.: +1 860 486 2408.
[2] Tel.: +1 860 486 3062.

0167-9236/$ – see front matter © 2011 Elsevier B.V. All rights reserved.
doi:10.1016/j.dss.2011.04.002

role of ad rank on conversions, and so on, but within the context of the search channel. Our research draws upon a Google ad-dataset that includes search as well as content channels, and focuses on the interaction effects between the search and content channels. This aspect has not been studied hitherto.

Since advertisers have a choice of displaying their ads over Google's search channel and/or content channel, this raises several questions for advertisers and service providers — do ads shown on one channel affect the likelihood of similar ads being clicked on the other channel, and if they do, should ads be shown over both channels, or over one channel only? In addition, if both channels are chosen, how should the ad budget and impressions be optimally allocated between the two channels? This question is complicated by the fact that both channels are owned by the same firm (i.e. Google). These will be the main research questions studied in this paper. These questions are of importance to online advertisers which need to make channel selection and budgeting decisions with regard to their ad campaigns. Further, these questions are of importance to researchers seeking to better understand the growing impact of online keyword based advertising.

We explore these questions by first formulating an empirical model to examine the interaction effects between the two channels. Our results suggest the presence of significant cross-channel cannibalization: with an increase in the number of impressions on either channel, the click-through rate for the other channel decreases.[3] While this result would imply that the advertiser and service provider should stick with one channel to display ads, this decision is complicated by our further finding on the presence of within-channel decreasing returns to impressions: with an increase in the number of impressions on either channel, the click-through rate for that channel decreases as well. Given the presence of both effects, how channels should be utilized optimally becomes a non-trivial question. We explore this optimal channel utilization problem by formulating a two-stage game theoretic model of interaction between the advertiser and service provider (such as Google) based on our empirical findings. The game theoretic model also provides further managerial insights into the factors that affect the optimal allocation of ad dollars between the two channels. We find that when ad budget is very low (very high), it is better to use only the content (search) channel, but it is optimal to utilize both channels otherwise. Further, we find that when the ad budget increases, in order to properly incentivize the service provider, the advertiser should increase the cost-per-click for search, but not for content. Our research results will be of interest to online advertisers, as it will inform their ad placement choices and help them optimize their advertising dollars over multiple online channels.

The rest of this paper is organized as follows. Section 2 discusses the existing literature. Section 3 lays out the empirical analysis. Section 4 presents the game theoretic model with numerical analysis and results. Section 5 presents the conclusions and discussion.

2. Literature

Keyword based advertising is receiving increasing attention from academic researchers. Prior research on online keyword-based ads has examined this phenomenon from the perspectives of advertisers, service providers (such as Google), and consumers, exploring a range of questions pertaining to keyword auctions, improving rank allocation, impact of rank on clicking behavior, and adverse selection. Research in this area can be classified into various streams, based on the nature of problem being analyzed, which include (i) attempts to understand the optimal behavior of the service provider (such as Google or Yahoo) — e.g. by modeling keyword auction equilibria [15,16,21]; (ii) needs of the search intermediary — e.g. improved rank allocation mechanisms [8,22]; (iii) needs of advertisers — e.g. profitability of ad display rank [10]; (iv) behavior of advertisers, and implications for consumers who click on keyword based ads — e.g. quality uncertainty and adverse selection in performance based search advertising (use of cost per click) [1]; and (v) interaction effects between different aspects of keyword based search, with implications for advertisers — e.g. the relationship between what consumers search for and what they ultimately buy [11]. Our work is related to this stream of research on online keyword-based advertising. The novelty of our work lies in its focus on the impact of impressions on the click-through rates, both within and across advertising channels, which has not been examined in the prior studies mentioned above.

In the advertising literature, our work is most directly related to previous studies on media planning, and the optimal allocation of an ad budget among competing conventional media outlets. In one of the earliest papers in this area, Little and Lodish [14] propose a media model that will help advertisers make media decisions more effectively. Other work has considered the role of competing advertisers [17], the role of repetition (involving multiple media) on advertising effectiveness [18], and the possibility of collateral damage from advertising campaigns [5], wherein the ad message leaks to an “activist” audience for whom the ad was not targeted, resulting in damage to the brand. Gensh and Welam [9] study the optimal allocation of an ad budget over a set of interacting market segments over multiple periods. Our research is similarly concerned with optimal allocation of advertising budgets, with a focus on *online* keyword based advertising channels, in particular search and content channels.

Our work is relevant to the more general marketing literature on advertising as well. Recent work on online marketing has focused on a number of related issues. Chatterjee et al. [4] model consumers' proclivity to click on banner ads. Shaffer and Zettelmeyer [20] study the role of third party websites such as Edmunds.com that provide free information on competing products, and the implications for the vendors' product sales. More recently, Danaher et al. [7] propose a method to optimally select online media channels and the advertising impressions to be displayed from the chosen media. However, their work focuses on banner ads rather than keyword-based ads, and on traditional measures of advertising effectiveness such as reach, frequency and effective frequency as applied to impressions rather than click-throughs. Danaher [6] develops and applies a multivariate generalization of a negative binomial distribution to page views across multiple websites, to predict the audience for internet ad campaigns. But none of this prior work has examined the impact of ad impressions on the within-channel and cross-channel information seeking behavior (i.e., clicks) of consumers, which is the focus of our study. Addressing the information seeking behavior of consumers is difficult or impossible in a conventional advertising setting, due to the absence of a reliable means of tracking information-seeking behavior by consumers. Our online ads dataset makes this analysis possible.

3. Empirical analysis

3.1. Data description

We obtained data from eight different Google Adwords accounts (for eight separate companies, including a mix of for-profit and non-profit organizations) over one month period (between March 30 and April 30 in 2009). Each team (representing one firm) creates an account, which contains contact and billing information of the account holder. Each account can have one or more ad campaigns.

Google permits two kinds of ad campaigns — keyword-targeted campaigns, which use the cost-per-click pricing model, and site-targeted campaigns, which use the cost-per-thousand-impressions pricing model. In this project, all teams used keyword-targeted campaigns. Keyword-targeted campaigns run on both the Google.com search site and Google's content network (including all blogs and

---

[3] The cannibalization is with respect to the click-through rate, and not with respect to impressions.

دریافت فوری ← متن کامل مقاله

ISIArticles
مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات