

Online Advertisers' Bidding Strategies for Search, Experience, and Credence Goods: An Empirical Investigation

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ABSTRACT

The advent of keyword advertising raises many interesting questions regarding consumer search behavior, firms' advertising strategy, and the ensuing market dynamics. Our research investigates whether advertisers' bidding strategies for keywords differ across search, experience, and credence product categories, and examines the possible drivers of these differences. In particular, we examine the relationship between advertisers' quality and their bidding strategies and more importantly, if advertisers' bidding strategies differ across search, experience and credence goods, characterized by different degrees of quality-uncertainty. We also examine if the advertisers' valuation for being placed among the top of the search listings is different for advertisers in the search, experience, and credence product categories. Based on data about advertisers' bids collected from online paid-placement auctions, we find that there are significant differences in the bidding strategies of sellers of *search* goods as compared to sellers of *experience* and *credence* goods, and that there is significant adverse selection in product categories characterized by greater uncertainty. We also find that the relative valuation for premium placement is much higher among advertisers of *search* goods as compared to advertisers of *experience* and *credence* goods. Our findings could be explained by fundamental differences in consumer search behavior as well as the "quality signaling" (or lack thereof) potential of paid-placements across the different product categories. Ongoing research based on lab experiments seeks to systematically examine the possible drivers of differences in valuations across product categories and the implications of our preliminary findings.

Keywords

Sponsored search, online advertising, search goods, experience goods, credence goods.

1. INTRODUCTION AND MOTIVATION

It is well known that the Internet and electronic marketplaces have dramatically lowered the cost of consumers obtaining information about product offerings and prices as well as the cost of sellers communicating such information. Lowering search costs changes the dynamics of markets in fundamental ways. For instance, lower search costs increase economic efficiency by promoting competition and also enhance welfare by providing a better match

of buyers and sellers. As noted by Bakos [2] lower search costs also allow new markets, such as for second-hand cameras or collectibles, to emerge.

Of the various Internet-related technologies, search engines have always played a pivotal role in the consumer search process. In addition to using search engines for finding information, online consumers are increasingly using search engines to shop for various goods and services [18]. Consequently, the most popular search engines have evolved from 'information-retrieval tools' to 'intermediaries' and 'information marketplaces' with significant economic power. The power of search engines is best illustrated by the following quote.

*"Patrick Ahern has witnessed the power of Google -- and the difficulties of trying to do business without it. Data Recovery Group, where he is president, would typically come up around the fourth listing on Google's popular search engine last year. Then in January, when Google removed the company from its listings without explanation, Data Recovery saw a 30 percent drop in business. So powerful has Google become that many companies view it as the Web itself: If you're not listed on its indexes, they say, you might as well not exist."*¹

Renewed excitement about the potential of combining online search and advertising has replaced the disenchantment with online advertising. In particular, the "pay-for-performance" or 'sponsored-search' model -- where advertisers bid for placement (to be as close to the top) in the listing of the search results for specific keywords -- is among the fastest growing online advertising model. According to recent estimates by Pacific Growth Equities the paid-search market will more than double in next three years and will be worth \$5.4 billion—60% of the U.S. online advertising market [7].

Pay-for-Performance Business Model: One of the interesting aspects of sponsored search (keyword advertising) mechanisms is the integration and co-evolution of online *search* and *advertising* business models. Given that search engines have become the starting point for Internet navigation, it is not surprising that advertisers have been trying to garner the attention of the online consumers through advertisements on the search engine results

¹Source: "Does Google's Power Threaten the Web?", CNET News.com

pages. In addition to being able to reach a vast audience, advertising on a search engine enables firms to target potential customers who are *actively* searching for a particular product/service. The pay-for-performance advertising model, generally, employs an auction mechanism wherein businesses can bid, for enhanced placement in (sponsored) search results, on relevant keywords used by consumers in their search process. Each advertiser pays the bid amount for each click-through but is not charged for the exposures. The higher the bid, the higher the advertiser's link appears in the results, which should typically lead to more sales leads (click-throughs) to the advertiser's site.

While the "pay-for-performance" advertising model has been growing rapidly, it differs from traditional (media) advertising in a number of significant ways. For instance, the payment structure (pay-for-performance), the sequential ordering of advertisements based on advertiser's willingness to pay, constraints on the amount and type of information that can be displayed, and most importantly the active search by consumers make online "pay-for-performance advertising models different from advertisements in traditional broadcast and print media. However, given the importance of these pay-for-performance advertising models for the emerging economic and competitive landscape, there has been surprisingly little research on their implications for consumers, and firms. Studies by Feng et al. [9] that provides a computational evaluation of alternate search models, and Kitts and LeBlanc [15] that presents an innovative trading agent for Pay Per Click (PPC) auctions, are some of the notable exceptions.

The presence of paid results in online search engines presents a new kind of informational problem in the digital realm. It is not surprising that a large number of consumers are unaware that in every search, paid listings are proffered along with algorithmic or organic listings. While search engines vary in their policy regarding the ordering and quantity of search listings, all of them are now required to highlight the sponsored results that they display. Sponsored search mechanisms may potentially introduce a bias in the listing of search results, and in the process, reduce the potential value of search to consumers. Gaudeul [11] discusses the inherent conflict of interest in this advertising model, where the information intermediaries deliver information about a seller's product, but are paid by those same sellers they "certify".

Traditional theories of advertising suggest that in addition to providing information to consumers, advertisements can also serve as an effective signaling mechanism. While there exists a large body of literature in economics and marketing that studies the relationship between *advertising* and *quality* in markets characterized by imperfect information, the results are inconclusive. The bids placed by advertisers (for placement in search engines listings) serve as an excellent proxy for online advertising spending of firms. Thus, data on bids by advertisers collected from sponsored search auctions in different product categories provide an unprecedented opportunity to test some of the predictions relating quality and advertising levels, in the online setting.

Sponsored search auctions that enable low quality bidders to be placed at the top of the search listings can adversely affect

consumer welfare and reduce the utility of such mechanisms for consumers. The success of the sponsored search mechanisms and the optimality of their design critically depend on understanding the nuances of firms' bidding behavior, and the drivers of firms' bidding strategies in the online keyword auctions.

Considering the growth of this advertising media and the lack of a systematic understanding about how consumers and the firms (advertisers) will behave in this media makes it an interesting and important research issue. Our research uses a combination of analytical modeling techniques, lab experiments, as well as empirical analysis of data gathered from the leading search engines, to examine several issues of interest. Broadly, our research seeks to understand the bidding strategies of firms in online sponsored search auctions. One of the primary objectives of this research is to understand how *firm* as well as *product* characteristics influence advertisers' bidding strategies in sponsored search auctions. Specifically, we examine the relationship between advertisers' quality and their bidding strategies and more importantly, if advertisers' bidding strategies differ across search, experience and credence goods, characterized by different degrees of quality-uncertainty. We also examine if the advertisers' valuation for being placed among the top of the search listings is different for advertisers in the search, experience, and credence product categories. Building upon existing theories of advertising in traditional media, our findings also provide insights into the effectiveness of "performance-based" advertising across different regimes of quality uncertainty.

2. RELATED RESEARCH

Search-Experience-Credence (SEC) Framework: Of particular relevance to advertising is the search-experience-credence goods framework, which has its roots in the marketing literature. Attributes of goods can be analyzed in terms of three properties – search, experience and credence [5, 20]. "These properties are used to categorize the point in the purchase process when, if ever, consumers can accurately assess whether a good possesses the level of an attribute claimed in advertising" [10]. Search goods have characteristics that are identifiable through inspection and prior to purchase. Experience goods, on the other hand, have features that are revealed only through consumption. The fact that consumers can never be certain of the quality and value of credence goods purchased even from *ex post* observations, differentiate credence goods from experience and search goods. The SEC classification is particularly useful in examining the role of information provision and market performance, as well as in examining the influence of media on consumer search process [16]. It is pertinent to note that the boundaries between these categories are fuzzy, and the categories represent regions in a continuum. The three product categories primarily represent the uncertainty characterizing the purchase of these products and the consequent implications for information provision and advertising.

Prior research suggests that consumer search behavior is likely to be different across these three product categories. In particular, there is a systematic difference in the marginal benefit to a consumer from the search for experience goods and the marginal

benefit from search for search goods [19]. To the extent that advertisements are informative, a consumer will look at an advertisement if the marginal benefit is greater than the cost (time and effort) involved in examining/processing the advertisement [19]. Since consumer search strategies drive advertisers' strategies [10], any significant differences in consumer search (information seeking) strategies will be reflected in subsequent differences in advertisers' strategies as well. In summary, the market power of consumers on advertising is likely to operate quite differently for search, experience, and credence goods.

Advertising and Search: Studies on firm advertising strategies in traditional channels posit the use of different mechanisms by sellers across search, experience and credence product categories [10]. Search goods, as defined by the SEC framework, have low pre-purchase uncertainty. Therefore, the advertisers for search goods primarily resort to informative advertising to promote differentiation amongst products. At equilibrium, a low quality firm will not be able to sustain high levels of advertising as consumers can easily ascertain the quality of goods before purchase. Consequently, we would expect a positive relationship between firms' quality and advertising expenditure for search goods.

On the other hand, experience and credence goods are characterized by higher uncertainty, requiring sellers of these goods to signal their quality to help reduce the uncertainty. Sellers of experience and credence goods typically resort to dissipative advertising, or mechanisms that provide indirect information about quality, by means of signaling. Firms may use various signaling mechanisms such as pricing [24], warranty [12], advertising [19], selling through reputable retailers [3] or any combination of the above.

Both analytical modeling and empirical studies are mostly inconclusive regarding the relationship between firm quality and their advertising levels. Pioneering work by Nelson [19] showed that in the presence of high levels of uncertainty associated with the good, high-quality brands will spend more on advertising in equilibrium than low-quality brands. Since the benefits from advertising are greater for goods with higher uncertainty, high quality firms will find it beneficial to signal their quality. Hence advertising expenditures are likely to be positively related to quality. This positive relationship between quality and advertising levels typically hold when there are *repeat purchases* [13, 19], *a large proportion of informed consumers in the market* [13, 17], and *differences in cost structures of high quality and low quality firms* [14, 17].

The failure to meet one or more of the above-mentioned conditions, along with the presence of high uncertainty, renders the signaling mechanism ineffective, causing high quality sellers to drop out of the market. Thus in markets with adverse selection, low quality sellers drive out higher quality sellers leading to a market breakdown [1]. When there is a high proportion of naïve consumers, and one-shot purchases, lower quality firms will typically find it optimal to advertise more, due to their lower cost structures, as compared to high quality sellers. Researchers have suggested that in such cases there exist

equilibria in which the lower quality brands advertise the most [4, 23].

In summary, advertising strategies for sellers of search goods are likely to be very different from those for sellers of experience and credence goods. The SEC framework is thus very useful in understanding the relationship between quality and advertising levels in the context of sponsored search.

3. DATA

Following the SEC framework, we selected 12 products within each of the three product categories – i.e. search, experience and credence goods. Though, as mentioned earlier, most of the products may exhibit all three search attributes – i.e. search, experience and credence and therefore can be categorized in more than one category, we classified each good in one of the three categories as commonly used in marketing literature [6]. The list of the products used in this research is borrowed from Ekelund et al [6]. We restrict our focus to products that have a sufficient number of advertisers bidding for keywords representing the specific products. A sample of the list of products in each of the three categories is shown in Table 1.

TABLE 1. PRODUCT CLASSIFICATION			
	Search Goods	Experience Goods	Credence Goods
1	Books	Cruises	Psychics
2	CD	Moving & Storage	Cosmetic Surgery
3	Cell Phones	Auto Insurance	Therapy

Data Collection: In the next step, we collected data on advertisers' bidding strategy for each of these products/keywords. As described earlier, advertisers (such as a retailer, manufacturer, wholesaler and/or infomediary) bid for specific keywords related to their product to get better advertisement placements in the sponsored search results. We collected bid data from one of the online intermediaries that conducts auction to allocate the positions on the ranked advertisement lists. The data was collected daily for the 32 products that were in the list, over a period of two months in 2004. The data about the bidder (i.e. the website address) and their respective bids (i.e. the dollar amount that the advertiser is willing to pay to the intermediary for every click on its advertised link) on each day was collected from the intermediary's website. The dates on which there were no bids are ignored in calculating averages. To ensure that the advertisers that are not regular bidders and bid infrequently do not influence the results, we excluded those bidders who have bid less than 20 days in the total sample-period of two-months.

We also gathered data on firm quality from Alexa.com. We gathered data on traffic ranks, consumer website ratings, the number of incoming links to a website, along with detailed measures for page reach and range and the change statistics for all of the above measures over different time periods (3 months, 1 month, 1 week and 1 day). Alexa.com collects this data from the users that participate and contribute this information by using the

Alexa toolbar. Prior research in IS has employed similar data as a proxy of quality [21] as well as proxy for firm's brand equity or social capital [22].

Measures: The firms are ordered by their average rank in the sponsored search listings over the period of our data collection (not including the days that they did not bid) and the top twenty ranked firms (positions described by variable POSITION²) are then selected to form a smaller subset. In this study we focus on the top 20 ranked firms in each product category (SEARCH, EXPERI, and CREDEN).

We capture the advertisers' bidding strategies using a set of variables that represent the dynamics of the bids placed and the ranks obtained by the sellers in the search listings. The four specific variables that characterize firms' bidding behaviors are LNAVGBID, LNBIDDEV, LNRNKDEV, and LNBDFZ (all are log transformed). LNAVGBID is the average bid placed by the firm over the period that bid data was collected for, excluding the days that it did not participate in bidding during the data collection period. To calculate LNBIDDEV, we first calculate percentage bid differences between two consecutive days for each of the days that the firm placed bids, and then use the standard deviations of these relative bid changes. We perform similar calculations to determine the rank deviations for a firm, LNRNKDEV. These deviation measures thus calculated provide a measure of the volatility associated with the bids placed and the ranks obtained. For the fourth variable, LNBDFZ, we order the firms by their average bids placed in a product category, and select the top 20 firms. LNBDFZ measures the relative valuation of ranks (i.e. incremental benefit to a firm by moving from lower rank to the next higher rank). This variable is calculated by subtracting the bid at the rank in question from the bid at the next higher rank (i.e. one position higher). For e.g. value of LNBDFZ for the second position = highest average bid – second highest average bid, for third position = second highest bid – third highest bid, and so on³). We normalize this variable by dividing it by the average of first twenty bids for that product/keyword. This would enable us to compare across products that may have different prices, profit margins and variations in terms of absolute bid amounts. We also create a variable, "BIDRANK" which refers to the position of a firm as per its average bid (i.e. highest bid, within a keyword, is assumed to be allotted first rank/position and so on).

Firm quality is captured through measures like the number of incoming links to a firm, or INLINKS, average user or customer ratings received by a firm on a scale from 0 to 5, or USERRATI, and its traffic rank, TRAFFICR⁴. These three measures are collected from Alexa.com, an Amazon.com company that provide web information services by analyzing the Web usage of millions

²Note that the naming of this variable may be a source of confusion in that this is reverse coded, as in a lower value of POSITION represents a better ranking, or higher placement in the listings

³ LNBDFZ for the first rank is equal to 0.

⁴ This number is reverse coded, such that higher values indicate lower quality

of their toolbar users. The first of these quality measures, number of in-links has been popularized by search intermediaries like Google that use the number and quality of the links pointing in towards a firm as a measure of the website quality. We use these measures as a proxy for seller quality. Customers visiting seller websites also rate their purchase and shopping experiences, which Alexa averages over all ratings to produce a user-rating score for the seller's website. Overall traffic rank is a combination of historical page view rank (fraction of all the page views by toolbar users go to a particular site, per million) and page reach, which measures the number of users (percentage of all Internet users who visit a given website) of the website. These three quality measures are found to be highly correlated, and for the purposes of our analysis, we only use traffic rank, as it is the most reliable and complete among the three.

A categorical variable, "TYPE" was also created to represent search, experience, and credence category in the ANOVA test. To examine the effect of position or placement in the rankings, we use a variable, NPOSITION, which is calculated by dividing the firm's average ranking (POSITION) by the total number of unique firms that bid for that keyword. This serves to control for differences in the number of firms, which may influence bidding dynamics among online sellers.

4. ANALYSIS AND RESULTS

We are primarily interested in examining the differences in the bidding strategies of firms across the three product categories. We use regression analyses to examine the effect of firm quality, product characteristics, and position in listings, on average bid, bid volatility and rank volatility (see Table 2). The following paragraphs document the findings from the regression analyses.

TABLE 2: QUALITY, UNCERTAINTY, AND BIDDING BEHAVIOR

	LNAVGBID	LNBIDDEV	LNRNKDEV
Source	Model 1	Model 2	Model 3
LNBIDDEV			0.354***
LNAVGBID		0.711***	0.083*
NPOSITION	-0.566***	0.005	-0.255***
EXPERI	0.341***	-0.214***	0.031
CREDEN	0.174***	-0.139**	0.093***
LNTRFFIC	-0.001	-0.243***	-0.098***
EXPERI*	0.027	0.072	-0.033
LNTRFFIC			
CREDEN*	0.034*	0.072	0.007
LNTRFFICR			
F-statistic	F(6, 655)= 113.00***	F(8, 653)= 79.92***	F(10, 651)= 78.01***
R ²	0.506	0.556	0.556
N, total df	662	662	662

An interesting finding in model 1 is that firms' average bid differs across products types and there appears to be an “inverted-U” relationship between increasing uncertainty and average bids. This is likely a result of differences in product categories in terms of their profit margins and click-through and conversion rates. Our results indicate that experience goods have the highest value/benefit from appearing in the sponsored search results.

We find that high average bids (i.e. at the top ranks) have higher bid volatility (model 2) and higher rank volatility (model 3) which suggests that competition is more intense for the top positions, across all product categories. We also find that there are significant differences in bid volatility across different product categories as well as across sellers of different qualities. The results from model 2 indicate that search good sellers (and high-quality sellers) who exhibit higher bid volatility, actively manage their bids as compared to credence and experience goods sellers.

Rank volatility (similar to bid volatility) was also found to differ across product types. We find that credence goods have higher rank volatility than search or experience goods. In other words, both search and experience goods have consistent/stable rankings compared to credence good sellers. Previous result shows that search goods have higher bid volatility as compared to credence and experience goods. The two findings taken together may seem paradoxical but can be explained by the relationship between bid and rank volatility. While bid and rank volatility are generally correlated, they need not always be so. For example, while placed bids are solely determined by the firm itself, its rank in the search listings is a function of not only its own bid but also that of all other firms participating in the sponsored search auction for a given keyword. Therefore, these findings indicate that there is higher competition among search good firms, and that they monitor and change their bids to maintain their position. Hence we see higher bid deviation and lower rank deviation for search goods as compared to experience and credence goods.

One of the most interesting findings is that lower quality firms bid higher in the case of experience and credence goods, as seen in model 1 of Table 2, suggesting that some of the concerns regarding sponsored search mechanisms are valid. Allowing firms to bid for placements in search results introduces a bias in the listing of search results, for experience and credence goods characterized by greater quality uncertainty. However, this adverse selection is present only in the market for experience and credence goods and is non-existent in markets for search goods.

Finally, we present the results from the ANOVA analysis where we use LNBDZF as the dependent variable, which measures the relative valuation of a position/rank relative to a position one rank higher than it. We test whether the relative valuation for position differs across products by using interaction terms “BIDRANK” and “TYPE”. The result of ANOVA test is presented in Table 3. The results show that relative valuation of positions is significantly different across products categories, (refer Figure 1a and Figure 1b).

TABLE 3: RELATIVE VALUATIONS ACROSS PRODUCT CATEGORIES			
Dependent Variable: LNBDZF (relative valuation)			
Source	df	F	Sig.
Corrected Model	59	3.019451	0.00
Intercept	1	370.2166	0.00
BIDRANK * TYPE	59	3.019451	0.00
Corrected Total	715		

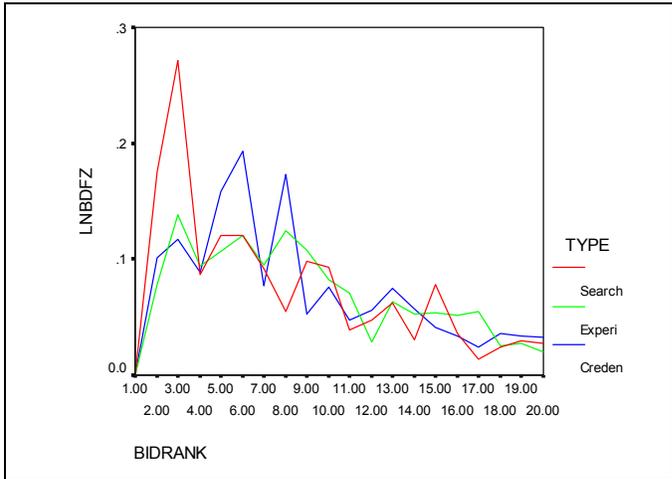


Figure 1a: Line Graph for Relative Valuation

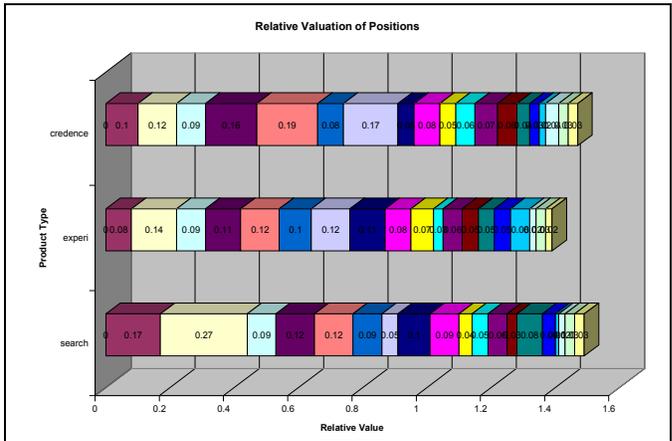


Figure 1b: Bar Graph for Relative Valuation

Figure 1b provides an alternative representation of the data illustrated in Figure 1a. The X-axis in Figure 1b measures the distance (relative valuation) between two consecutive positions/ranks. The origin is the absolute valuation for the first position. Each horizontal bar in the graph represents a product category (i.e. search, experience and credence from bottom to top). The point where the first block in a horizontal bar ends

marks the location of the second position. The length of the block denotes the distance (for e.g. 0.17 in case of search good), in terms of relative valuation, between first position and second position. Similarly, the point where the second block in a horizontal bar ends marks the location of the third position and so on and so forth. It is clear from the graph that relative valuation, in case of credence and experience goods, is almost the same for two consecutive ranks near the top of the listing. However, in the case of search goods, the move from third to second position is more valuable than move from fourth to third position.

We also conduct multiple comparisons (i.e. Tukey) test to compare adjacent ranks and find that relative valuation for moving from the third rank to the second rank is significantly different than relative valuation for moving from fourth rank to the third rank in case of *search* goods. The results might be indicative of consumer click-through patterns for the search listings. It appears that for search goods, consumers are more likely to click through the top two links and the click-throughs for the links that are ranked lower falls steeply. In such a case the relative value of moving from third rank to second rank is likely to be much higher than the relative valuation of moving from fourth rank to the third rank.

5. CONCLUSIONS AND FUTURE RESEARCH

The preliminary results of our study of advertisers' behavior in sponsored search auctions suggest that advertisers' behavior is significantly different across search, experience and credence product categories. Advertisers of search goods seem to value the top two ranks significantly more than do advertisers of experience and credence goods. For sellers of experience and credence goods the difference between two consecutive ranks is not dependent on the rank (i.e. does not vary across ranks)⁵. Recently, Feng [8] has studied a related issue in terms of differences in valuation of consecutive ranks by an advertiser. She proposes optimal allocation mechanism under different characterizations of bidder valuations, based on how bidder valuations change for consecutive ranks. Our results complement this stream of research.

Firms that bid high appear to be actively managing their bids in an effort to maintain or move up in the ranking of search results. Heightened competition is likely to cause a firm to bid more than is optimal for the firm at that position, benefiting the search service provider. Further, high-quality firms manage their bids more actively than low quality firms. This suggests that sponsored search auctions might be more valuable for high-quality firms. Given, the dynamic nature of online markets, it is also possible that only high-quality firms have the ability to undertake sophisticated data analysis and forecasting to maximize their returns from their online investments

⁵ It is important to note that what we are looking at is the difference between two consecutive ranks (i.e. comparing the normalized bid difference of rank 1 and 2 vis-à-vis normalized bid difference of rank 2 and 3, and so on).

Our analysis uncovers an adverse selection problem in the case of experience and credence goods, which presents a significant problem for consumers, regulators, as well as the sponsored search intermediaries. Product categories which lack adequate quality information (and for which it is costly to ascertain quality) are the ones where lower quality firms bid higher and appear on the top of the search results listings. This could adversely affect consumer welfare, particularly for uninformed consumers and consumers who trust the search results provided by these search engines. However, with informed consumers, or with better signaling and reputation mechanisms this bidding behavior (low quality firms bidding higher) is unlikely to prevail in the long-run. The fact that there is greater entry and exit of advertisers (bidders) in product categories with greater uncertainty (credence goods, in particular) also suggests that there is a greater turnover of bidders in this category and highlights the lack of reputation effects. The infancy of online sponsored search markets could be another factor that facilitates adverse selection. In the case of search goods, where there is less quality uncertainty, we do not find any significant distortion or bias in the search listings.

We believe that these differences in advertisers' strategies and their valuation for different ranks are due to the differences in consumer's search behavior across search, experience and credence goods. Differences in consumers' search behavior across the three product categories are likely to result from their beliefs about the usefulness of the rankings of the search results in these product categories. In other words, if the consumers do not believe that the ranking (of sponsored search results) and quality are positively correlated, they are less likely to search sequentially. This could reduce the importance of a higher ranking for firms, leading to less competitive bids for keywords in certain product categories. While the results presented here are preliminary, they nevertheless, suggest interesting differences in bidding patterns for keywords in different product categories. These results also underscore the importance of using SEC framework in analyzing the advertising strategies of the firms in this emerging context.

These findings are particularly relevant for the providers of search services, as search listings that are biased can reduce consumer welfare and eventually the profitability of the intermediary as well as drive out higher quality firms. Our findings suggest that search service providers would do well to incorporate reputation mechanisms and additional signals of quality (such as user reviews) in their search listings. Thus, search results that are weighted both by the bids and quality signals can help alleviate some of adverse selection problems prevalent in product markets with higher inherent uncertainty.

While this is a potential problem for firms, intermediaries, and consumers, it is also possible that sponsored search mechanisms in fact enable lesser known firms (and new entrants) to bid higher and reach out to more consumers by bidding appropriately online. Thus, it would be important to differentiate between firms that sell low-quality products, and those that tend to be classified as low-quality due to the lack of adequate quality signals (traffic, inlinks, etc.). While the former can adversely affect welfare, the latter could actually improve social welfare.

Finally, it is clear that market forces act differently for different product categories. The dynamics of bidding strategies by firms are not only indicative of the significance of sponsored search auctions for these firms, but also can provide interesting insights into the competitive landscape within product categories/keywords. A more extensive analysis of such bidding dynamics promises to shed light on relative competition across different product categories as well as the existence of strategic groups within product categories.

Our future research extensions include designing an experimental study to examine consumer's search behavior across search, experience and credence goods. Analysis of actual consumer click-throughs for keywords in these different product categories will serve to reinforce the findings from our experimental studies. In addition to differences across product categories, we also seek to examine if there are differences in the bidding patterns across different types of firms (manufacturers, retailers, infomediaries, etc.). We hope that our research studies will provide a systematic understanding of consumers' search strategies in these different product categories and help generate practical guidelines for advertisers as well as intermediaries. We believe that this workshop will provide us an excellent opportunity to interact with practitioners and academicians working in this challenging and interesting field and forge mutually beneficial research partnerships. We also hope to get constructive feedback and comments on our ongoing research.

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