

# DISSERTATION DEFENSE

## Essays on Sponsored Search Advertising

Amin Sayedi

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324 GSIA (West Wing)

My dissertation examines the strategic interactions of search engines and firms in sponsored search advertising. In my first essay, I study how a firm decides to allocate its advertising budget between sponsored search advertising and traditional channels of advertising. An advantage of sponsored search advertising is that, since the firm advertises in response to a consumer-initiated search, the sales-conversion rate is typically higher than in display advertising. However, a disadvantage of sponsored search advertising is that, to "steal" the firm's customers, its competitors can also bid on its keyword, therefore driving the advertising costs higher. Using a game theory model, I study the implications of these tradeoffs on the advertising decisions of competing firms, and on the design of the sponsored search auction by the search engine. I find that symmetric firms may follow asymmetric budget allocation and bidding strategies. Moreover, the search engine benefits from discouraging competition in sponsored search auctions by shielding firms from competitors' bids. This explains the practice of employing "keyword relevance scores", under which search engines such as Google, Yahoo! and Bing under-weight the bids of firms bidding on competitors' keywords. I also obtain various other interesting insights on the interplay between sponsored search advertising and traditional advertising and support the results by short-term and long-term data collected on poaching behavior of firms in several industries.

Prior auction theory literature has paid relatively little attention to budget constraints. In the second essay in my dissertation, motivated by sponsored search advertising, I introduce a mechanism for budget-constrained advertisers. The mechanism, a generalization of the Vickrey auction, is near-Pareto optimal in ex-post Nash equilibrium. Furthermore, understating budgets or values is weakly dominated. Since revenue is increasing in budgets and values, all kinds of equilibrium deviations from true valuations turn out to be beneficial to the auctioneer in the proposed mechanism.

In the third essay of my dissertation, I look at "exclusivity contracts" in sponsored search advertising. As sponsored search becomes increasingly important as an advertising medium for firms, search engines are exploring more advanced bidding and ranking mechanisms to increase their revenues from sponsored search auctions. For instance, Microsoft, Yahoo! and Google are investigating auction mechanisms in which each advertiser submits two bids: one bid for the current display format in which multiple advertisers are displayed, and one bid for being shown exclusively. If the exclusive-placement bid by an advertiser is high enough then only that advertiser is displayed, otherwise multiple advertisers are displayed and ranked based on their multiple-placement bids. I study a natural modification of the GSP mechanism that Yahoo! has recently proposed. I show that although allowing the advertisers to bid for exclusivity can generate higher revenue for the search engine, under certain conditions, it can also create new class of equilibria with significantly lower revenue. Allowing exclusivity might be better or worse for the advertisers depending on their values for exclusivity as well as the heterogeneity in their values for exclusivity. Finally, when exclusive bidding is allowed, even if exclusive display is not the outcome, the search engine can extract higher revenue because allowing two bids increases the competition among the advertisers.