

## **Bidder collusion in sponsored search auctions**

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In this paper we aim at studying the extent to which the *generalized second-price auction* (GSP) is sensitive to bidder collusion when introducing a third-party known as *search engine optimization experts* with the ability to implement monetary transfers. Sponsored links are sold using real-time auctions. Each time a user enters a query, an automated auction is triggered putting the most correspondent advertisers in competition. Since the first works by Varian (2007) and Edelman et al. (2007), characterizing the full-information set of Nash equilibria of the GSP, there has been an extensive ground of studies extending their model in various dimensions. Actually, sponsored search markets are characterized by the presence of third-parties who offer bidding services. Namely, they enter the auction as bidding on the behalf of several firms (advertisers). This important feature is absent of existing models. We propose a model of position auction that incorporates those third-parties as agents facilitating collusion in complete information. Although it is a standard issue in auction theory, not much has been said regarding the sensitivity of the GSP to bidder collusion either. As collusion has substantial effects on the final allocation and on the seller's revenue this question is of high practical concerns. Interestingly, the GSP seems to be robust to certain forms of collusive schemes. We find that if the collusive gain is redistribute among members in a non-strategic way, the best that can be achieved is non-cooperative profits. Bidders do not have sufficient incentives to reduce even more their expressed demand. We then provide elements upon which payment rule should be implemented by the center in order to give the highest utility to advertisers subject to maximizing its own profits. We also provide conditions under which bidders can enhance efficient collusion and thus also contribute to the literature on collusion in multiple-objects simultaneous auctions.