

# Measuring Complementarities in Vertical Markets: Evidence from the Digital Advertising Industry

Andrea Chiantello, Francesco Decarolis, Maris Goldmanis and Antonio Penta\*

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## Abstract

The digital advertising industry is characterized by a proliferation of specialized intermediaries helping advertisers in their purchases of online ad space. This study contributes to the analysis of the vertical complementarities in this market by posing and estimating a structural econometric model of how advertisers match to their intermediaries. Exploiting novel data and some recent methods in the estimation of many-to-many matching games for large markets, we quantify the value created by the matches, their driving forces and, counterfactually, evaluate the likely effects of the growing concentration among intermediaries. The estimates clearly show that competing advertisers benefit from dealing with a common intermediary and, moreover, offer a precise quantification of various forces including industry specialization, exclusive contracting and diversification.

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\*Chiantello, Bocconi University, [andrea.chiantello@studbocconi.it](mailto:andrea.chiantello@studbocconi.it). Decarolis, Bocconi University and IGIER, [francesco.decarolis@unibocconi.it](mailto:francesco.decarolis@unibocconi.it). Goldmanis, Department of Economics, Royal Holloway, University of London, [Maris.Goldmanis@rhul.ac.uk](mailto:Maris.Goldmanis@rhul.ac.uk). Penta, ICREA-UPF, Barcelona GSE and TSE Digital Center, [antonio.penta@upf.edu](mailto:antonio.penta@upf.edu).

# 1 Extended Abstract

Digital advertising is a new, large and rapidly growing industry. In 2019, total digital ad spending is expected to be worth more than 300 billion US dollars globally. But taking advantage of the opportunities offered by digital advertising requires advertisers to adopt novel technologies and acquire specialized skills. Most firms, and especially those which are not in the tech sector, rarely invest to develop these capabilities in-house, but rely instead on outsourcing these functions to specialized intermediaries. These intermediaries, commonly referred to as Digital Marketing Agencies (DMAs), offer a disparate variety of services to their clients, ranging from managing their bidding strategies on online ad auctions platforms, to the design and management of their ad campaigns more broadly. Despite the relevance of this vertical relationship between advertisers and intermediaries, still only a few studies have analyzed its drivers and implications. In this study, we contribute to the understanding of such vertical relations by posing and estimating a structural econometric model of how advertisers match to their intermediaries. The main objective is to quantify the value created by these matches as well as their driving forces and, counterfactually, evaluate the likely effects of the growing concentration among intermediaries which this market is witnessing.

We build on earlier research about intermediaries in ad auctions to formulate a model of how intermediaries create value for their clients. Besides the diversity of services DMAs offer to their clients, the complexity of the vertical relationship we aim to understand is further increased by the peculiar industrial relationships which characterize the organization of this market. In particular, while at the level of single agencies this market appears to be relatively fragmented,<sup>1</sup> most of these agencies actually belong to a few *agency networks* (seven in the U.S.) that implement and sometime coordinate some of the DMAs' activities. Such a market structure thus creates a very rich set of potential channels through which agencies can create value for their clients. We consider various such channels, but we focus especially on the role of market specialization, exclusive contracting and diversification.

The aspects of the market discussed above open the door to rich set of potential patterns for advertisers' preferences, who might in principle display both complementarities or substitutabilities over the matchings between other advertisers and marketing agencies. An advertiser, for instance, might evaluate either positively or negatively the possibility of hiring an intermediary who also manages the ad campaigns of its rival advertisers: Although sharing a marketing agency might create conflicts – as suggested, for instance, by both theoretical ? and empirical ? studies on the advertising industry before the digital revolution – the benefits in the realm of digital advertising can be disparate, including access to better data and the possibility of bid coordination in the auctions where online ad space is sold.<sup>2</sup>

Our empirical analysis employs a large dataset that links, among the top 6,000 US advertisers, every firm active in the digital advertising market to one (or more) specific advertising agency for all major US industries between 2015 and 2017. Deals between firms and intermediaries are modeled

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<sup>1</sup>According to the US Census Bureau's 2016 annual report, there are 12,000 marketing agencies in the US, with 8,000 of them having less than four employees and 10,800 less than 20. The advertising agencies with more than 100 employees are 285 and account for 60% of the employment in the sector.

<sup>2</sup>As shown by DGP1, in the main existing auction formats, bid shading (and, hence, price reduction) is in fact feasible for an intermediary which handles ad purchases on behalf of multiple advertisers that are interested in the same type of ad space.

as the result of a (many-to-many) matching game. Although matching games are commonly used for modeling specific applications such as marriage, school applications, kidney exchanges and employment choices, they are relatively less used for vertical markets where matching between firms takes place along the supply chain. This is likely due to the lack of systematic data covering the vertical matches in an industry, but also because of the inherent complexity associated to analyzing matching problems in settings, such as the present one, in which parties are not constrained to a single match (hence the many-to-many matching framework). In this work, we overcome both difficulties. For the first one, we rely on a novel firm-level dataset we specifically developed for this study, by combining several data sources on the digital ad industry. For the second difficulty, we exploit the Maximum score estimator proposed by ?, which is ideal to deal with large markets such as the one we consider. As discussed below, this estimation approach exploits the features of the stability notion (?) used to solve the game to avoid the severe curse of dimensionality which would plague other approaches, if applied to large markets. The estimation procedure makes the problem computationally tractable and allows us to structurally estimate the preference parameters for advertisers and intermediaries which determine the matching between them, as well as to evaluate counterfactual changes in the market structure.

The results, albeit still preliminary, clearly show that competing advertisers benefit from dealing with a common intermediary. In particular, the estimates offer a precise quantification of the industry specialization effect for intermediaries, exclusive contracting, diversification and other non evident network phenomena that are usually of interest in the study of industrial organization. Perhaps the most interesting finding is that advertisers seem to prefer not to share *marketing agencies* with their direct competitors, but at the same time they prefer to match to agencies belonging to the same *agency network* as the agencies that manage their competitors. A closer look at the way DMAs operate suggests a simple economic explanation for this result. In particular, while the creative activities and strategic decisions associated to the design and management of the advertising campaigns take place at the level of the marketing agencies, the functions of (algorithmic) bidding and data analysis happen at the level of the agency networks (within specialized units known as “agency trading desks”, or ATDs – see Section 3 for a more detailed description of the market’s institutional details). Hence, on the one hand, our analysis confirms earlier findings in the literature on common agency phenomena (?) : as long as traditional marketing activities are concerned, advertisers still prefer to avoid joining agencies which also manage the campaigns of their direct competitors; on the other hand, our results show that agencies do value the positive spill overs made possible by the modern activities specific to online advertising, such as the data analysis and bidding functions.

It thus appears that the two-layers structure which has emerged in this market – with more traditional functions operated at the agency level, and the more modern functions of algorithmic bidding and data analysis at the higher agency network level – provides a way of balancing the pros and cons from "sleeping with the enemy" (that is, of joining an intermediary also hired by a direct competitor), by closely mirroring the structure of advertisers’ preferences as emerged by our estimation: all traditional activities, which the earlier literature had identified as reasons to avoid a common intermediary, are still operated at the agency level; the more modern functions of algorithmic bidding and data analysis, which were expected to generate positive spill overs from sleeping with the enemy, are operated at the higher agency network level.

We conclude with an assessment of the potential effects of mergers between intermediaries. This analysis is motivated by the rapidly increasing concentration among intermediaries observed in recent years, and by the importance of understanding its impact on the advertisers' welfare of advertisers. At this stage, our approach is not a full counterfactual analysis, but more an evaluation of the advertisers' change of surplus under different ownership structures for the agencies. Although our results are particularly preliminary in this part of the study, we believe that this analysis might opens up a new angle and methodology to quantitatively analyze the changing competition landscape in digital markets, taking into account the rich structure due to both the diversity of services offered by the agencies, as well as the specific organizational structure emerged in the industry.