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Evaluating structural and behavioral remedies for anticompetitive conducts in the ad tech ecosystem☆

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ABSTRACT

Alphabet's extensive vertical integration across the ad tech stack has come under increased scrutiny from competition authorities. This paper examines how Alphabet's alleged leveraging practices, including tying of first-party inventory and data, restrictive interoperability, and discriminatory auction rules, undermine multihoming and foreclose rival intermediaries. Drawing on a structured analysis of anticompetitive effects and claimed efficiencies, we show that purely behavioral remedies would require constant, resource-intensive oversight in an opaque, rapidly evolving ecosystem. By contrast, a more focused structural realignment, specifically divesting Alphabet's buy-side services from its publisher-facing operations, directly removes conflicts of interest while refraining from intrusive divestiture of consumer-facing platforms. This targeted breakup has the potential to foster genuine competition across the ad tech value chain, mitigates the need for perpetual monitoring, and if complemented by behavioral remedies, preserves important efficiencies that benefit advertisers, publishers, and users.

1. Introduction

Programmatic advertising has reshaped digital marketing, enabling real-time ad purchases instead of relying on manual negotiations or static placements. While major platforms like *Facebook* and *Amazon* manage these processes in-house (Facebook, 2024), smaller publishers depend on third-party services, collectively known as the *ad tech stack*, to monetize content. This stack consists of ad servers, demand-side platforms (DSPs), and ad exchanges, which automate the matching of advertisers' demand for targeted impressions with publishers' available inventory. Like Internet Service Providers and content providers, whose mutual dependence creates value (Peitz & Valletti, 2015), advertisers and publishers rely on intermediaries for ad allocation. Ideally, all parties benefit: advertisers achieve precise targeting, publishers maximize revenue, and intermediaries profit from transaction fees.

However, outsourcing ad placement introduces a principal–agent dilemma: intermediaries may prioritize their profits over advertisers' and publishers' interests (Frick et al., 2023). This risk intensifies when a single firm operates across multiple transaction stages, controlling both ad inventory supply and advertiser bidding platforms. Indeed, vertical integration in ad tech markets has mixed effects. On one hand, it reduces latency and enhances user identification, improving real-time ad auctions (CMA, 2020c). On the other, integrated firms can favor their own services, creating conflicts of interest. Effective competition is therefore essential to

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prevent distortions and ensure ad placements serve advertisers and publishers rather than intermediaries (Mehran & Stulz, 2007; Walter, 2004).

Alphabet's dominance across the ad tech stack has drawn scrutiny from global regulators. Reports from the U.K. Competition and Markets Authority (CMA) (CMA, 2020c, 2024), the Australian Competition & Consumer Commission (ACCC) (ACCC, 2021), and the U.S. Department of Justice (DOJ) (DOJ, 2023) suggest Alphabet leverages its market power to foreclose rivals, using control over inventory and bidding to exclude competitors. This weakens competition, reducing publisher revenue, raising marketing costs, and dampening innovation. The ultimate burden falls on consumers, who face fewer ad-funded online services and potentially higher retail prices.

In response, regulators have proposed remedies ranging from behavioral rules to structural separation. The CMA (2020d) and ACCC (2021) advocate for sector-specific codes of conduct that could escalate if firms fail to comply. More recently, the DOJ (O'Reilly, 2024), the Canadian Competition Bureau (Competition Bureau Canada, 2024), and the European Commission (European Commission, 2023a) have signaled support for breaking up Alphabet's ad tech operations, though details remain uncertain. While calls for digital platform separation have been more prevalent in the U.S. (see, e.g., Khan, 2019), the European Commission's willingness to consider divestiture marks a shift. This aligns with Regulation (EU) 2022/1925, also called Digital Markets Act (DMA). The DMA, adopted by the European Parliament and the Council of the European Union in September 2022, is a regulation for digital 'gatekeepers' operating 'core platform services' (CPS), which primarily imposes conduct obligations but allows structural remedies in case of 'strategic non-compliance' (de Streel et al., 2024). The Commission's early consideration of a breakup in ad tech, before exhausting behavioral measures, underscores the depth of its concerns and the strong incentives for anticompetitive behavior in this sector; notably, the Commission has designated all of Alphabet's ad tech services collectively as a single CPS, along with services such as *YouTube*, *Google Search*, *Google Maps*, and *Android* as CPS subject to the DMA (European Commission, 2023b).

This paper contributes to the debate on Alphabet's ad tech dominance by integrating regulatory findings into an economic framework. First, it examines how Alphabet's alleged leverage strategies restrict multihoming and entrench its dominance. Second, it evaluates the limitations of behavioral rules, emphasizing their enforcement challenges in a complex, fast-moving market. Third, it proposes that divesting Alphabet's buy-side services for third-party inventory, while preserving legitimate synergies, offers a balanced structural remedy. By linking conduct analysis with policy assessment, the paper aims to inform regulatory approaches for fostering competition in ad tech.

The paper is structured as follows. Section 2 outlines the ad tech ecosystem and Alphabet's role. Section 3 examines alleged anticompetitive practices. Section 4 compares behavioral and structural remedies in terms of effectiveness and proportionality. Section 5 concludes.

2. Background on Alphabet's role in ad tech

The ad tech ecosystem automates real-time transactions between advertisers (the "buy-side") and publishers (the "sell-side") via programmatic auctions. These auctions boost publisher revenue and improve advertiser campaign performance. Many intermediaries work at different layers of this value chain. Fig. 1 shows a simplified process that distinguishes between external services and Alphabet-owned offerings (see,e.g., CMA, 2020c; Yuan et al., 2014).

When a user visits a publisher's webpage or app, their browser requests ads from the publisher's ad server. The ad server, which manages and reports on ad delivery, first serves fixed contracts and then sends unsold inventory to ad exchanges (Zawadziński & Sweeney, 2024).

Ad exchanges and demand-side platforms (DSPs) work together to set ad prices in real time. An ad exchange is a marketplace that connects available impressions with advertiser demand.[1] Prices for each ad impression are set through real-time auctions.[2] To gauge advertiser valuations, ad exchanges add user data to each ad opportunity and send bid requests to DSPs. DSPs automatically purchase ads across exchanges and publishers, usually on a cost-per-mille (CPM) basis.[3] An exception is *YouTube* and *Google Search*, which Alphabet sells exclusively through its own DSPs (CMA, 2020c, pp.102–103).

After information about the impression has reached advertisers and they have decided on their valuations, advertising expenses flow through the value chain as follows:

1. **DSPs forward bids to ad exchanges.** A DSP typically submits one bid per campaign to avoid self-competition (Allouah & Besbes, 2017) and sends its net bid (after DSP fees) to the exchange. Smaller advertisers often use *Google Ads* for its ease of use and access to *Google Search* and display inventory. Larger advertisers often complement their *Google Ads* campaigns with *Display & Video 360* (DV360) for more advanced targeting, premium inventory access, and programmatic buying. Notably, Alphabet's DSPs mainly forward bids to its own ad exchange, *AdX*.

[1] Some reports also label ad exchanges as supply-side platforms (SSPs) (e.g., ACCC, 2021; CMA, 2020a). Historically, SSPs helped publishers manage demand from multiple ad networks. Over time, SSPs and ad exchanges merged. We collectively refer to SSPs, ad exchanges, and ad networks like *Google AdSense* and *Google AdMob*, which offer similar auction-like functionality, as "ad exchanges".

[2] Because impressions vary by user, auctions are the common method to allocate online ads to the highest bidders at the time of bidding.

[3] CPM denotes cost per thousand impressions.

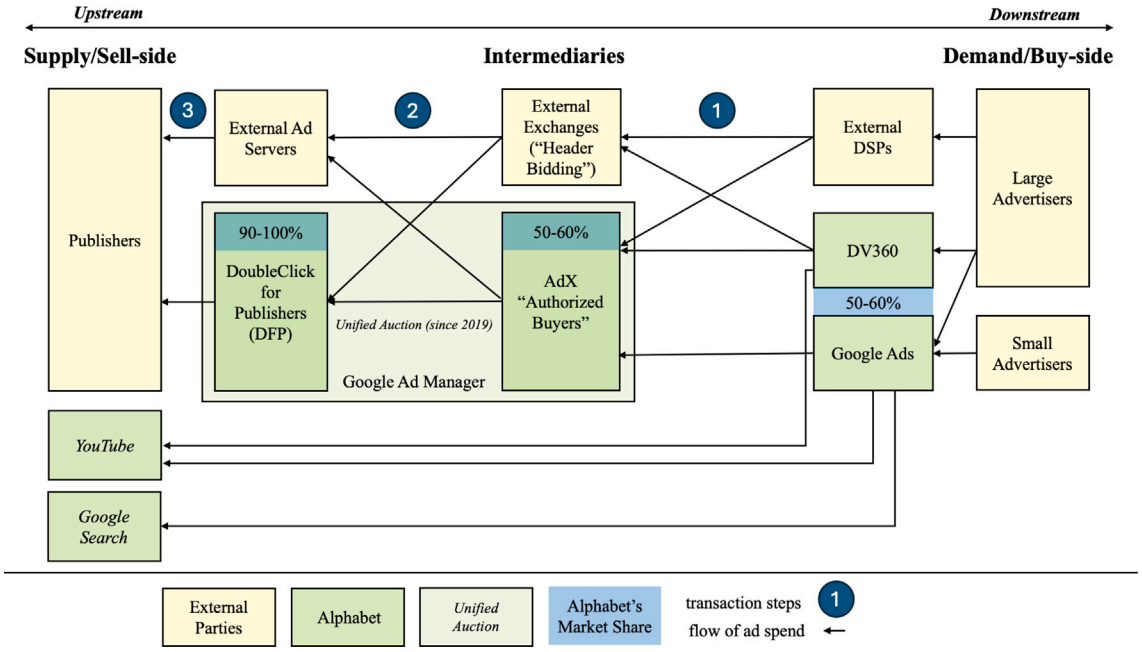


Fig. 1. Sequence of the programmatic display advertising transaction process. The circled numbers indicate the steps in the flow of ad spend from the buy-side to the sell-side. Alphabet's estimated market share at each stage is shown as percentages.

2. **Ad exchanges run auctions to select the winning bid.** After receiving bids, an exchange holds an auction and forwards the winning net bid (gross bid minus the exchange fee) to the publisher's ad server. Although second-price auctions were once common, most exchanges switched to first-price auctions after header bidding emerged around 2015. Header bidding lets publishers collect bids from several exchanges simultaneously instead of sequentially (a practice known as "waterfalling"), making first-price auctions more efficient (see, e.g., Balocco et al., 2020; Despotakis et al., 2021; Paes Leme et al., 2020).
3. **The publisher's ad server picks the highest net bid.** Typically, the ad server selects the highest net offer from all competing exchanges. Previously, *DoubleClick for Publishers* (DFP) compared *AdX*'s bids with those from other exchanges. In 2018, Alphabet merged DFP and *AdX* into *Google Ad Manager* (Ramaswamy, 2018) and, a year later, combined *AdX*'s separate second-price auction into a unified first-price auction managed by *Google Ad Manager* (Bigler, 2019). Now, DSPs using *AdX* are called "Authorized Buyers" and send bids directly to *Google Ad Manager*, competing with external exchanges (Google, 2018). We use *AdX* and "Authorized Buyers" mostly interchangeably, but we distinguish between DFP and *Google Ad Manager* to mark the change in Alphabet's sell-side auctions.

Public reports show that Alphabet is the dominant player in the ad tech value chain. For example, CMA (2020a) reports that, as of 2019 in the U.K., Alphabet held 90%–100% of the ad server market by volume and 50%–60% of the ad exchange and DSP markets by value. Other competition authority reports provide similar estimates (ACCC, 2021; DOJ, 2023; FCA, 2021).

3. Competition concerns in Alphabet's ad tech practices

Competition concerns in ad tech center on Alphabet's vertical integration and leveraging incentives. Ad tech markets are two-sided, connecting advertisers and publishers (Choi et al., 2020). By controlling multiple steps in the transaction process, Alphabet may foreclose rival intermediaries by leveraging positive network externalities.

Two-sided markets create positive network externalities when each side values access to the other (Rochet & Tirole, 2003). Such externalities affect competition based on whether users singlehome (use only one platform) or multihome (use several platforms). When both sides singlehome, network externalities can lead to a "winner-takes-all" outcome, where users choose the platform with the largest complementary user base. In contrast, if one side multihomes, multiple platforms can compete for the singlehoming side's transactions (Armstrong, 2006; Jullien & Sand-Zantman, 2021). In that case, competition shifts to price or quality because no platform holds exclusive access to the other side. Alphabet's leveraging practices restrict multihoming, thereby reducing its procompetitive effects.

Although no final legal decision has been reached about the anticompetitive nature of Alphabet's conducts, we proceed on the assumption that provisional findings by regulators and reports are confirmed. This approach ensures a comprehensive evaluation of the potential harms identified by competition authorities and public inquiries.

3.1. Analytical framework for evaluating leveraging practices

We use a structured framework to study the anticompetitive effects of Alphabet's leveraging practices. Leveraging happens when a firm uses its market power in one market to gain an advantage or block competition in another. Our framework follows three steps:

1. **Assessing the Anticompetitive Potential.** We first ask whether the conduct can harm competition in a target market. A firm must have enough market power in the market where the leverage originates. Since ad tech is a two-sided market, we also check if the firm influences both advertisers and publishers enough to overcome their natural incentives to switch or use multiple platforms.
2. **Evaluating the Anticompetitive Impact.** If the conduct appears harmful, we then examine whether it is likely to foreclose rivals. In this step, we consider factors that may increase or reduce the anticompetitive effect, such as whether rivals can differentiate their offerings.
3. **Weighing Efficiency Gains Against Anticompetitive Effects.** If foreclosure seems likely, we ask whether any efficiency gains can offset the harm to welfare. Claimed gains must be substantial, and there should be no less restrictive means to achieve them.

Our framework follows a 'rule of reason' approach (Ahlborn et al., 2004; Tirole, 2005) that evaluates net effects on competition and welfare on a case-by-case basis. The following subsections apply this framework to Alphabet's alleged leveraging practices.

3.2. Tying first-party inventory and data to DSP services

In economics, "tying" refers to the practice of linking one product or service to another, potentially leveraging market power across distinct services (Tirole, 2005).[4] Specifically, Alphabet ties its high-value advertising inventory and extensive consumer data exclusively to its DSPs. Advertisers value a DSP not only for its price but also for its access to inventory and data (CMA, 2020c, p.43). Advertisers who want access to the inventory from Alphabet's consumer services, such as *YouTube* and *Google Search*, and user data from *Chrome*, *Android*, *Gmail*, or *Google Maps* must use *DV360* and *Google Ads* (CMA, 2020c, pp.102–103). Moreover, access to *Google Search* advertising inventory and data is exclusive to *Google Ads* (DOJ, 2023; Google, 2024, pp.38–39). By restricting these key inputs to its own DSPs, Alphabet makes them more attractive compared to rival platforms.

3.2.1. Anticompetitive potential of tying practices

3.2.1.1. Alphabet's market power in in-stream video advertising. In-stream video ads capture user attention by integrating into video content, such as preroll or midroll ads that viewers must watch before proceeding. This seamless integration gives advertisers an engagement advantage (ACCC, 2021; Frade et al., 2021).

YouTube has a much larger user base than other in-stream video ad publishers. With 2.7 billion monthly active users globally (Global Media Insight, 2024), *YouTube* far exceeds competitors like *Amazon Prime Video* and *Netflix*. For example, *Amazon Prime Video* has about 230 million users worldwide (Shewale, 2024), and *Netflix* has around 70 million ad-supported users globally (Statista, 2024).

High entry barriers strengthen *YouTube*'s market power. Its large scale creates strong network effects that attract both content creators and viewers, solidifying *YouTube*'s role as a key advertising channel.

3.2.1.2. Alphabet's market power in search advertising. Search advertising displays ads alongside search results and targets users based on their queries. *Google Search* dominates this market, processing nearly 90% of global search queries (StatCounter, 2024). Its dominance is reinforced by data-driven network effects that boost search quality with increasing returns to scale (Krämer & Schnurr, 2022). As more users engage with Alphabet, the variety of queries, including rare long-tail ones, increases, providing a steady flow of data to refine its algorithms and improve quality (see Prüfer & Schottmüller, 2021, for a theoretical treatment).

High entry barriers protect Alphabet's search advertising lead. Competitors like Microsoft's *Bing* struggle to match the scale of data needed to improve their algorithms at a similar pace (CMA, 2020a, pp.92–94). These dynamics keep Alphabet's dominance in search advertising largely unchallenged.

3.2.1.3. Alphabet's market power as a supplier of targeting data. Alphabet holds significant power over advertisers by controlling extensive targeting data. This strength comes from both the *breadth* of data collected across many users and the *depth* of data on each user (Krämer & Schnurr, 2022). The CMA (2020b) describes Alphabet as "the platform with the largest data set collected [...] [with] more data, of more types, from more sources than anyone else" (p.15). In practice, each major Alphabet product supplies unique data that together create detailed user profiles. *Google Search* captures queries that reveal users' interests or purchase intentions; *YouTube* records watch history and engagement; *Maps* logs frequent locations; *Gmail* archives transactional and personal correspondence; *Chrome* tracks browsing activity; and *Android* provides signals such as app usage, location data, and system events. When users are logged into a Google Account, these streams combine to form detailed profiles that help Alphabet target specific user segments for better ad performance.

[4] Our use of tying is thus to be distinguished from illegal tying in the sense of antitrust law.

3.2.2. Anticompetitive impact of tying in the DSP market

3.2.2.1. Tying amplifies network externalities for Alphabet's DSPs. In the DSP market, advertisers usually singlehome, using only one DSP per campaign, while publishers commonly multihome by working with several DSPs. This equilibrium forces each DSP to compete hard for advertisers to keep their offerings attractive to publishers. Advertisers avoid using multiple DSPs for one campaign due to practical inefficiencies such as managing frequency capping, merging performance reports, and avoiding redundant bids (CMA, 2020c, p.49). Volume-based discounts also encourage advertisers to concentrate spending on a single DSP (e.g., Google, 2020a, offers such discounts). Although larger advertisers might use different DSPs for different campaigns (CMA, 2020c, p.48), publishers typically connect with many DSPs to access more demand.

Alphabet disrupts this balance by tying access to its high-value inventory (e.g., *YouTube*, *Google Search*) and exclusive user data to its own DSPs. By acting as a singlehoming publisher, Alphabet increases the overall value its DSPs offer through better targeting and unique reach. Faced with the choice of a single DSP for a campaign, advertisers often choose Alphabet's DSPs, putting independent DSPs at a persistent disadvantage.

3.2.2.2. Amplifying and mitigating factors across different advertiser segments. Alphabet's tying arrangement affects advertiser segments differently. Because smaller advertisers find it more difficult to multihome across DSPs than larger advertisers, leveraging network externalities through data and inventory access creates a stronger lock-in. Limited budgets and expertise incentivize smaller advertisers to use only one DSP for a campaign and across campaigns (CMA, 2020c, p.98). Access to a variety of different digital advertising formats including search, display, and video, along with access to Alphabet's first-party data provide strong incentives to use *Google Ads*. Another distinct advantage of *Google Ads* is pricing. *Google Ads* offers a cost-per-click (CPC) model (Google, 2020b) that shifts inventory risk away from advertisers by charging only for clicks. This approach ensures cost predictability and minimizes wasteful spending. While advertisers can pay per click, *Google Ads* pays publishers on a cost-per-mille (CPM) basis, incurring costs regardless of user interaction. To limit such 'inventory risk', *Google Ads* relies on precise click-through rate (CTR) estimates from Alphabet's extensive first-party data. High CTR estimates allow *Google Ads* to bid more aggressively, confident in its ability to recover costs by billing advertisers. Rival DSPs lack access to such comprehensive CTR data, making it hard for them to adopt a similar CPC model without significant risk. This pricing advantage locks in smaller advertisers and amplifies the anticompetitive effects of the tying arrangement.

In the larger advertiser segment, the anticompetitive effects of tying are less severe. Larger advertisers have larger budgets, greater expertise, and more operational capacity, which lets them use different DSPs for different campaigns. Although they also rely on *Google Ads* for exclusive *Search* inventory, their higher capacity allows them to switch more easily between DSPs for more sophisticated targeting, including DV360, reducing overall lock-in. This multihoming of larger advertisers creates opportunities for DV360's rivals to differentiate their offerings by attracting unique supply that fits each campaign's needs. For example, DSPs like *The Trade Desk* and *Amazon DSP* offer access to alternative premium inventories and data (ACCC, 2021, pp. 97–98). *The Trade Desk* provides access to *TikTok*, although this inventory is also available via *TikTok*'s self-service ad manager, reducing its role as a differentiator. *Amazon DSP* offers first-party inventory from *Twitch* and *Amazon Prime Video* and leverages its customer data for targeting. Although these alternatives are not perfect substitutes for *YouTube*, either due to differences in scale or because *TikTok* does not offer in-stream video inventory, they do create competitive pressure on DV360.

3.2.3. Weighing efficiency gains against anticompetitive effects

Tying *YouTube* and *Google Search* to Alphabet's DSPs creates efficiencies for advertisers. For smaller advertisers, using a single platform lowers transaction costs by unifying search, in-stream video, and display ad formats under one interface. Alphabet argues that its exclusive control of *YouTube* protects ad quality and privacy by screening out malicious ads and reducing the number of third parties that handle user data (CMA, 2020c, p.104). In addition, integrating data from its widely used consumer services into display campaigns can improve targeting accuracy and raise the value of impressions.

However, competition authorities question whether these benefits require tying. The CMA (2020c, pp.104–105) finds that allowing controlled third-party access to *YouTube* could preserve most ad-quality and privacy protections while still enabling rival DSPs to compete. Similarly, improved ad targeting from combining *Google Search* data with display might be achievable without excluding other DSPs, provided that adequate safeguards for user data are in place. In sum, while the tying arrangement offers some efficiencies, these benefits are neither unique nor indispensable. They do not outweigh the anticompetitive harm or justify blocking rivals from accessing Alphabet's valuable inventory and data.

3.3. Restricting advertiser multihoming to strengthen ad exchange market power

Alphabet limits advertisers using its DSPs from using multiple ad exchanges, which strengthens its control over publishers in the ad exchange market. Its DSPs preferentially route bids to its own ad exchange, *AdX*, denying rival ad exchanges the scale they need on the demand side. This practice channels network effects from Alphabet's large advertiser base to *AdX*, making it harder for competitors to attract publishers.

3.3.1. Anticompetitive potential of preferential routing

Alphabet's preferential routing builds on its tying arrangements (see Section 3.2) to reinforce its market power. On the publisher side, Alphabet's DSPs generate strong network externalities due to their scale and exclusive access to advertiser demand. Publishers value these interactions because Alphabet's DSPs capture a large share of market demand (see Section 2).

Although *Google Ads* represents only 10%–20% of the total impression value (CMA, 2020c, p.45), this measure understates its importance. *Google Ads* brings unique demand from smaller advertisers that is not available elsewhere. While these advertisers may have tighter budgets and contribute less in value, they purchase a significant volume of impressions. For example, the ACCC (2021, p.64) reports that in 2020, *Google Ads* accounted for 50%–60% of the impression volume purchased through DSPs in Australia. Moreover, the distinct preferences of smaller advertisers and the unique data provided by *Google Ads*, such as data from *Google Search*, help publishers sell inventory that might otherwise remain unsold (DOJ, 2023, p.38). Accordingly, reports by CMA (2020c, p.109), DOJ (2023, p.38), ACCC (2021, p.59), and FCA (2021, p.52) all agree that publishers place a premium on access to *Google Ads*.

3.3.2. Anticompetitive impact of preferential routing in the ad exchange market

3.3.2.1. Preferential routing of bids amplifies network externalities for Alphabet's ad exchange. In the ad exchange market, multihoming by both advertisers and publishers lessens the competitive impact of network effects (CMA, 2020c, pp.59–60). Typically, when one side multihomes, the marginal benefit for the other side to use an additional platform declines because extra platforms do not offer many new users (Jullien & Sand-Zantman, 2021). However, both sides choose to multihome in the ad exchange market since neither publishers nor advertisers know in advance which platform will offer the best outcome.

For publishers, multihoming increases the chance of receiving the highest bid for each impression. Because an advertiser's value for an impression depends on real-time factors, such as user characteristics, context, and targeting data, publishers are uncertain about which exchange will yield the best bid. By offering impressions on several exchanges, publishers access a larger pool of bidders, which can boost competition and raise their revenues (CMA, 2020c, p.59).

Advertisers bid across multiple ad exchanges to address two main uncertainties: dynamic exchange pricing and technical integration failures. Each exchange deducts a fee from the top "gross" bid it collects from advertisers, creating a "net" bid that the publisher sees (see Section 2). The publisher then compares all net bids and awards the impression to the highest one. Thus, for each impression, ad exchanges effectively compete as bidders with known valuations (the highest gross bids) in a first-price auction (Zeithammer & Choi, 2024). When an exchange wins, it keeps the difference between the advertiser's gross bid and the net bid it pays to the publisher. A lower fee raises the net bid and boosts the chance of winning, but it also shrinks the exchange's surplus if it does win. Because exchanges lack information about bids placed on rival platforms, a static fee is risky. Instead, they adjust fees dynamically to maximize expected surplus (see e.g., Balseiro et al., 2017; Zeithammer & Choi, 2024). This strategy mirrors bid shading in first-price auctions, where bidders bid below their true valuations to balance the probability of winning with preserving surplus (Krishna, 2009). As competition grows, exchanges shade less, i.e. reduce their fees, to strengthen net bids. Because an exchange may fail to forward a sufficiently competitive net bid (for various reasons), advertisers can improve their winning probability by bidding across multiple ad exchanges for the same impression. Advertisers also face technical hurdles that may undermine their chances of winning an impression on a given exchange. Each exchange and advertiser (i.e., its DSP) relies on unique user identifiers that must be matched in real time (Papadopoulos et al., 2019). A failed match deprives advertisers of key data, causing them to bid conservatively or not at all (CMA, 2020c, p.34). Timeouts and latency vary, too. Publishers or ad exchanges can discard late bids to their auctions, leaving advertisers shut out (CMA, 2020c, p.35). By distributing their bids across multiple exchanges, advertisers hedge against these pricing and technical uncertainties, thus raising their overall probability of winning impressions at favorable terms.

By preferentially routing bids from its DSPs to its own ad exchange, Alphabet limits the benefits of advertiser multihoming in the ad exchange market. Although both of Alphabet's DSPs also send bids to rival exchanges, they do so only to a limited extent. For instance, *Google Ads* submits bids to rival exchanges only when the impression is not simultaneously offered on *AdX* (ACCC, 2021, p.101). Meanwhile, DV360 may bid on multiple exchanges but systematically submits lower bids on rivals compared to *AdX*. According to the DOJ (2023, pp.90–91), Alphabet's practice known as *Project Poirot* reduces DV360's bids to rival exchanges by 10%–90%.

Consistently bidding lower or less often on rival exchanges effectively has advertisers singlehoming from the publisher's perspective. To illustrate, suppose an advertiser bids on impressions through two ad exchanges, A and B. If the advertiser always submits a higher bid b_A to A and a lower bid $b_B = b_A - x$ to B, where $x > 0$, and assuming both exchanges charge similar fees, the advertiser will always win through A. In a first-price auction, the highest bid wins, so the bid submitted to B never competes effectively. This logic holds regardless of the number of advertisers, as competition between bidders occurs across the entire market, not within individual exchanges (Despotakis et al., 2021). Thus, advertiser multihoming becomes irrelevant to the publisher.

By limiting advertiser multihoming through preferential routing and bid shading, Alphabet channels the network externalities from its large advertiser base exclusively to its own exchange, *AdX*. Hence, publishers seeking the highest bids from Alphabet's DSPs must rely on *AdX*.

3.3.2.2. Publisher multihoming as a mitigating factor. Before header bidding, publishers were engaging with ad exchanges sequentially, starting with the one that historically provided the highest average revenue (CMA, 2020c, p.7). In this system, *AdX* held an inherent advantage because many advertisers singlehomed on *AdX* through Alphabet's DSPs, making it the preferred starting point for publishers. As a result, a rival exchange with a potentially higher real-time bid often never had the chance to compete.

Header bidding, as discussed in Section 2, changed this process by allowing publishers to request real-time bids from multiple ad exchanges at once. This shift enabled rival exchanges to compete more effectively against *AdX*, for example, by lowering fees or offering better data. However, while header bidding reduces the risk of foreclosure in the ad exchange market, the discriminatory auction rules built into Alphabet's ad server continue to undermine the procompetitive benefits that header bidding could otherwise provide (see Section 3.5).

3.3.3. Weighing efficiency gains against anticompetitive effects in the ad exchange market

Although Alphabet's preferential routing of bids from its DSPs (*Google Ads* and DV360) to its own ad exchange (*AdX*) creates some operational efficiencies, these gains do not outweigh the anticompetitive harm. Vertical integration can streamline user-ID matching when both buy- and sell-side systems share the same identifier (CMA, 2020c, p.34) and co-located infrastructure can reduce latency in bid processing (Srinivasan, 2020), thereby improving bid success rates. However, advertisers already place bids across multiple exchanges to handle uncertainties about fees, user matching, and timeouts. These efficiency gains would still be available if Alphabet's DSPs fully participated in rival exchanges rather than funneling all bids exclusively to *AdX*.

Similarly, while bid shading in first-price auctions (as seen in *Project Poirot*) can help advertisers maximize expected surplus, the systematic lowering of bids by DV360 on rival exchanges does not improve overall market efficiency. By artificially reducing bids on competing exchanges, it may deprive advertisers of opportunities to secure impressions at lower effective prices, thereby reducing allocative efficiency.

In sum, although integrated infrastructures and data interoperability can offer technical benefits, these do not require exclusive preferential routing. The anticompetitive harm caused by restricting advertiser multihoming is not mitigated by such efficiencies, so any claimed gains fail to justify practices that foreclose rivals and limit competition.

3.4. Restricting vertical interoperability to foreclose rival ad servers

Alphabet limits the interoperability between its ad exchange, *AdX*, and external ad servers. This practice forces publishers to use Alphabet's ad server in order to efficiently access demand from *AdX*. Before 2018, publishers could efficiently access *AdX* demand only by adopting DFP; since then, *Google Ad Manager* has been the sole efficient means to access "Authorized Buyers". In effect, publishers are compelled to use DFP/*Google Ad Manager* to tap into the significant advertiser demand channeled through *AdX*.

Although this conduct does not meet the strict legal definition of *tying*, it extends the same concerns of preferential routing from the DSP–ad exchange relationship to the ad server market. The advertiser demand from Alphabet's DSPs is available only on *AdX*, and *AdX* demand is efficiently accessible only through DFP/*Google Ad Manager*. As a result, the practice produces economic outcomes similar to anticompetitive tying (CMA, 2020c, p.113).

3.4.1. Anticompetitive potential of restricted vertical interoperability

AdX holds significant market power over both advertisers and publishers. Its power over advertisers comes from Alphabet's DSPs preferentially routing bids to *AdX* (CMA, 2020c, p.108). Because many advertisers rely on these DSPs (see Section 3.2), they have few alternatives to reach publisher inventory at scale outside of *AdX*. This preferential routing makes *AdX* a de facto bottleneck for advertisers seeking efficient access to supply.

Publishers view *AdX* as essential because it aggregates substantial demand. For example, the CMA estimates that in 2019 *AdX* accounted for 50%–60% of the total value of inventory sold through ad exchanges in the UK (CMA, 2020c, p.56). Similarly, the ACCC estimates that in 2020, 70%–80% of ad impressions in Australia were traded over *AdX* (ACCC, 2021, p.58). Publishers aiming to maximize revenue must access *AdX*'s demand, which in turn gives Alphabet significant market power over them.

3.4.2. Anticompetitive impact of restricted vertical interoperability in the ad server market

3.4.2.1. Restricting vertical interoperability amplifies network externalities for Alphabet's ad server. In the ad server market, publishers typically singlehome, that is, they use one ad server to manage all their ad inventory. This choice is driven by operational efficiencies, as centralizing management, reporting, and optimization simplifies their operations (CMA, 2020c, p.65). In contrast, advertisers expect their bids to reach many publishers and thus effectively multihome across ad servers.

Consequently, ad servers would compete for publishers based on price and service quality rather than on exclusive access to unique demand. Publishers can tap into multiple demand sources through their chosen ad server, which usually creates a competitive equilibrium where no single ad server dominates due to network effects.

Alphabet disrupts this equilibrium by restricting interoperability between its ad exchange, *AdX*, and external ad servers. In practice, *AdX* does not join header bidding that would allow publishers to solicit real-time bids from multiple exchanges simultaneously. Without real-time access to *AdX*, publishers using external ad servers must rely on less efficient 'client-side redirection', a form of sequential allocation that mimics legacy 'waterfall' logic, where *AdX* does not submit real-time bids (FCA, 2021, p.50).

This restriction creates a strategic dilemma for publishers on external ad servers. They may know the highest bids from exchanges participating in header bidding, but under client-side redirection must estimate *AdX*'s bid using historical averages. Publishers then

face a choice: allocate impressions to the known high header bidding offer and risk missing a better bid from *AdX*, or redirect impressions to *AdX* and hope for a higher yield. As noted by FCA (2021, pp.50–51), this gamble can add latency, degrade the user experience by increasing ad load times, and risks suboptimal yield.

In contrast, publishers using DFP/*Google Ad Manager* enjoy real-time access to *AdX*'s demand CMA (2020c, p.109). As a result, effective access to *AdX* demand is only possible when publishers adopt Alphabet's ad server. In effect, the real-time demand from the large pool of advertisers on *AdX* effectively singlehomes on Alphabet's ad server.

3.4.2.2. Vertical integration and switching costs amplify anticompetitive effects in the ad server market. Alphabet's anticompetitive impact is amplified by three key factors that limit rivals' ability to compete. First, external ad servers face steep price competition. Alphabet can cross-subsidize its ad server using profits from its DSPs and *AdX*, which lets it offer ad server services at very low or even zero cost. For example, the DOJ (2023, p.53) notes that Alphabet charges minimal or no fees for its ad server services, and the CMA (2020c, p.64) reports that Alphabet reduced ad serving fees by a factor of ten after acquiring DFP in 2008. Rival ad servers cannot match a de facto zero price without similar subsidies. In addition, operating an ad server involves significant fixed costs, including investments in technology, integrations, and maintenance. These costs do not scale proportionally with the number of publishers served (CMA, 2020c, p.64). Without a substantial user base, rival ad servers cannot achieve the economies of scale necessary to lower prices or invest in service improvements.

Second, publishers face substantial switching costs when moving to a different ad server. Switching is complex, time-consuming, and carries operational risks and potential revenue losses. Tasks like configuring inventory offers, migrating data, integrating systems, and training staff can take months and incur significant expenses (CMA, 2020c, pp. 65–67). Publishers also risk losing historical data and forecasting abilities, which undermines their ability to monetize inventory effectively. These high switching costs reduce the incentive to adopt rival ad servers, even if they offer lower prices or improved features.

Lastly, Alphabet's integration across the ad tech stack increases its competitive advantage. By using its ad server to favor its own ad exchange (see Section 3.5), Alphabet enhances the appeal of *AdX* to advertisers and thereby reinforces publishers' view that *AdX* is indispensable.

3.4.3. Weighing efficiency gains against anticompetitive effects

Alphabet argues that keeping *AdX* out of header bidding brings three efficiency gains: lower latency, greater transparency, and stronger user privacy (CMA, 2020c, pp.438–443). Indeed, header bidding can add hundreds of milliseconds to page loads, which may harm user experience (Aqeel et al., 2020; Pachilakis et al., 2019). Alphabet also contends that header bidding's decentralized design makes reporting less accurate, causing discrepancies in billable events and reducing transparency. In addition, adding more intermediaries may increase data protection risks.

However, publishers widely use header bidding because the revenue gains from parallel auctions usually outweigh any latency or reporting issues (Pachilakis et al., 2019). Transparency and privacy concerns can be managed with well-designed protocols and consent frameworks rather than by excluding *AdX* from real-time competition. Notably, Alphabet's own DSPs still purchase inventory via header bidding exchanges, suggesting that these issues can be addressed without shutting out *AdX* (CMA, 2020c, pp.442–443).

In short, the efficiency benefits Alphabet claims do not require keeping *AdX* out of header bidding. By excluding *AdX* from simultaneous real-time auctions hosted by rival ad servers, Alphabet strengthens its hold in the ad server market and limits publishers' revenue options. Thus, any gains in speed, transparency, or privacy are likely outweighed by the loss of competitive bidding and publisher choice.

3.5. Restricting publisher multihoming to foreclose rival ad exchanges and DSPs

Alphabet uses its ad server dominance to discriminate against rival ad exchanges and DSPs during auctions. By applying discriminatory auction rules through its ad server, Alphabet favors its own ad exchange and DSPs, effectively blocking competition. This practice limits the extent to which publishers can multihome across ad exchanges and DSPs, thereby reducing the procompetitive benefits of multihoming. Publisher multihoming, as noted in Section 3.3.2, helps counteract restrictions on advertiser multihoming in the ad exchange market.

By curtailing publishers' ability to multihome, Alphabet weakens the competitive pressure that would otherwise drive rival ad exchanges to differentiate their offerings and attract advertiser demand. As a result, *AdX* becomes more attractive to advertisers by providing a more efficient route to publisher inventory than its rivals. This further incentivizes advertisers to transact through *AdX*, which amplifies the anticompetitive effects of Alphabet's market power in the ad server market (see Section 3.4).

3.5.1. Anticompetitive potential of ad server discrimination

Alphabet's ad server holds significant market power over both publishers and advertisers. Its power over publishers comes from leveraging practices that restrict efficient access to advertiser demand from its DSPs and *AdX* (see Sections 3.3 and 3.4). These practices make Alphabet's ad server essential for publishers who want to maximize revenue from advertiser demand. This market power is further reinforced by publishers' singlehoming behavior, driven by operational efficiencies and high switching costs (see Section 3.4.2.2).

Alphabet's ad server also acts as a gatekeeper to publisher inventory, giving it power over advertisers. With a large share of impressions served through DFP/*Google Ad Manager*, efficient access to this inventory is critical for advertisers aiming to reach diverse audiences and achieve scale.

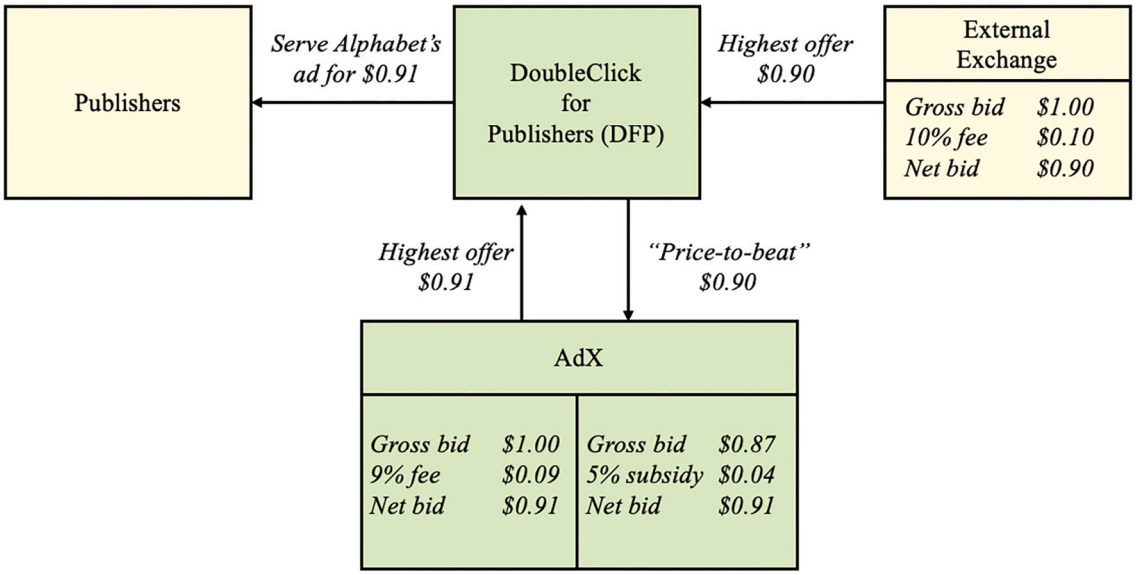


Fig. 2. By sharing the "price-to-beat" DFP enables *AdX* to outbid competitors with equal or higher bids by perfectly adjusting its revenue share. Numbers have been rounded to simplify the presentation. The example generalizes to the advantage of "Smart Bidding" for Alphabet's DSPs post auction unification in 2019.

3.5.2. Anticompetitive impact of ad server discrimination in downstream markets for ad exchanges and DSPs

3.5.2.1. Auction discrimination forecloses downstream rivals. Alphabet's ad server uses discriminatory measures that give its own downstream services an edge in auctions. By exploiting information and auction dynamics unavailable to rivals, Alphabet ensures that its services win auctions they would otherwise lose. Although the specific mechanisms differ between DFP and *Google Ad Manager*, the overall anticompetitive effect remains the same. From 2009 to 2019, before Alphabet unified its sell-side auctions, this discrimination operated through a DFP feature called *Dynamic Allocation*. This feature allowed DFP to share the highest rival ad exchange bid with *AdX* (whether that bid was based on historical estimates before header bidding or observed in real time afterward; see CMA (2020c, p.114)). By treating this highest rival bid as the effective reserve price, DFP granted *AdX* a "last look" advantage in the auction.

To explain the "last look" effect further, recall that ad exchanges act as bidders in the first-price auction run by the ad server (see Section 3.3.2). By sharing the "price to beat", DFP allows *AdX* to adjust its bid, such as by slightly lowering its fee, just enough to outbid a rival. Fig. 2 illustrates a numerical example: if a rival exchange submits a net bid of $0.90 (after a 10% fee on a $1.00 gross bid), *AdX* can secure the impression by reducing its fee from 10% to 9%, submitting a net bid of $0.91. Even if *AdX* starts with a lower gross bid (e.g., $0.87), it can "subsidize" its bid by charging a negative fee and still win. This practice of bid subsidies became known as *Project Bernanke*, whereby Alphabet would bank extra margins when competition was low to later tap additional liquidity needed to outbid competitors (DOJ, 2023, pp.61–65). Although offering prices below marginal cost on one market side is common in two-sided markets (Rochet & Tirole, 2003), the competitive harm here stems from Alphabet's use of superior information to help *AdX* outbid rivals. This practice allows *AdX* to win auctions it would otherwise lose and thereby denies rival exchanges the scale of supply needed to attract more advertisers.

After Alphabet transitioned to the unified auction in 2019, industry observers predicted that switching to a first-price auction would remove the "last look" advantage (Sluis, 2019). However, the key advantage does not come from whether the auction is first- or second-price but from Alphabet's ability to see the highest rival bid before placing its own (Geradin & Katsifis, 2020). In fact, under a first-price format the incentive to know other bidders' offers can be even stronger; by learning the next-highest bid, a bidder can reduce "winner's regret", the lost surplus from overbidding, by bidding only slightly more.

Both the DOJ (2023, pp.113–116) and the CMA (2020c, pp.125–126) indicate that Alphabet still employs a form of "last look". Now, this advantage is implemented through *Smart Bidding* in *Google Ads* and DV360 rather than through *Dynamic Allocation*. Introduced in 2019, *Smart Bidding* leverages Alphabet's superior access to rival bidding data, collected over more than a decade, to model the distribution of rival bids. This allows Alphabet's DSPs to predict the "price-to-beat" algorithmically, preserving essentially the same informational edge that *AdX* enjoyed under *Dynamic Allocation* for Alphabet's DSPs in the unified auction run by *Google Ad Manager*.

3.5.2.2. Amplifying and mitigating factors. Although the "last look" advantage continues to disadvantage rival exchanges and DSPs, several developments in Alphabet's ad tech ecosystem, specifically *Open Bidding* and *Minimum Bid To Win*, have attempted to mitigate these effects. In practice, however, these measures often impose new constraints or fees that still tilt the playing field. Conversely, some practices, such as *Unified Pricing Rules*, can even worsen foreclosure concerns.

Beginning in 2018, Alphabet allowed publishers to grant rival ad exchanges access to *Dynamic Allocation* via a proprietary header bidding alternative called *Open Bidding* (Cox, 2017). By offering rivals a comparable "last look" capability, *Open Bidding* aimed to narrow the gap with *AdX* (CMA, 2020c, p.10). However, *Open Bidding* charges a 5%–10% commission to rivals, reducing their net bids and partly offsetting any benefit. Moreover, Alphabet prevents vertically integrated rival exchanges from using their own DSP demand in *Open Bidding*, that would benefit from vertical synergies and technical efficiencies. Consequently, CMA (2020c, p.10) concludes that *Open Bidding* primarily protects Alphabet's exchange from real competition.

With the move to a unified first-price auction in 2019, Alphabet introduced a feature called *Minimum Bid To Win* (MBTW) to preserve the apparent mitigating benefits in *Open Bidding*. MBTW shares post-auction "price-to-beat" information with losing bidders and the runner-up bid with the winner, allowing rivals to better predict the maximum bid for each impression. On paper, this transparency could help a DSP or exchange bid just high enough to win, reducing the risk of overpaying. However, the benefit is limited because this information is only available to participants in *Open Bidding*, not to those using other header bidding solutions (CMA, 2020c, p.124). Without a standard for sharing partial post-auction bid data, the logistical burden is too high for most publishers. As a result, MBTW does not fully neutralize the informational edge that Alphabet enjoyed before the unified first-price auction.

While *Open Bidding* and MBTW may slightly reduce the anticompetitive harm of "last look", another practice, *Unified Pricing Rules* (UPRs), amplifies it. UPRs prevent publishers using *Google Ad Manager* from setting different reserve prices for different demand sources, which removes a key way for rival ad exchanges or DSPs to compete on price (CMA, 2020c, p.462). Without UPRs, publishers could offer lower reserve prices to rivals to counteract the advantage of Alphabet's DSPs in the *Google Ad Manager* auction. By enforcing a single reserve price for all bidders, Alphabet negates any cost advantage that rivals might provide, undermining their ability to attract advertisers.

This policy is similar to "wide" MFN clauses, which stop suppliers from offering lower prices in alternative channels than those provided by the platform (Crémer et al., 2019). By limiting a publisher's ability to differentiate reserve prices, UPRs restrict publisher multihoming and create a lock-in effect. Advertisers then have little incentive to move away from Alphabet's ad exchange or DSPs, and Alphabet's integrated stack retains its edge in data and scale, leaving fewer opportunities for outside competitors to win inventory or build a critical mass.

3.5.3. Weighing efficiency gains against anticompetitive effects

Alphabet defends its practices in the ad server market by citing two main efficiency gains. First, it promotes *Open Bidding* as a server-side alternative to traditional header bidding. According to Alphabet, "Open Bidding" reduces latency and simplifies publishers' access to header bidding, offering a more efficient method of selling inventory compared to the legacy, inefficient "waterfall system" (CMA, 2020c, pp.116–117). Traditional implementations of header bidding can add significant latency to webpages and are challenging to deploy efficiently (Pachilakis et al., 2019). By running its own version of header bidding via *Open Bidding*, Alphabet enables more publishers to access real-time auctions without the associated latency drawbacks. Importantly though, this benefit does not depend on excluding rival exchanges or preventing them from using their DSPs' first-party demand.

Second, Alphabet points to *Unified Pricing Rules* (UPRs) as a way to standardize reserve prices across exchanges. UPRs are intended to prevent inefficient mismatches, for instance, when a higher bid from *AdX* is blocked by a high reserve while a lower rival bid clears at a lower floor (DOJ, 2023, p.105). In theory, UPRs can streamline pricing and avoid inefficiencies that arise when publishers set reserve prices too high relative to the social optimum (see e.g., Zeithammer & Choi, 2024, on why publishers may set reserve prices too high compared to the social optimum). However, UPRs also curtail a publisher's ability to set different floors to attract demand on smaller exchanges, thereby limiting price competition (CMA, 2020c, p.123). As a result, any moderate gains in auction efficiency are offset by the foreclosure of rival exchanges' ability to differentiate through lower reserve prices. In fact, Alphabet's internal analyses indicate that inefficient allocations due to excessive reserve prices before the rollout of UPRs affected only slightly more than 5% of all impressions (DOJ, 2023, p.105).

Taken together, *Open Bidding* and UPRs do not fully justify Alphabet's discriminatory practices. While each measure may offer some operational benefits, both the CMA (2020c, p.123) and the DOJ (2023, p.106) conclude that these purported efficiencies do not outweigh the loss of competition and the reduced strategic choices available to publishers. The very design elements that lower latency or unify pricing floors also allow Alphabet to impose commissions on rivals, restrict their ability to compete, or prevent publishers from setting lower reserve prices for independent exchange demand. Thus, any efficiency gains are likely outweighed by the deeper anticompetitive harms arising from Alphabet's ad server acting as the dominant auctioneer.

3.6. Interim conclusion: Implications for competition, efficiency, innovation, and remedy design

Alphabet's practices have continually reinforced its dominance in the ad tech ecosystem. By tying services across *Google Search*, *YouTube*, DSPs, ad exchanges, and ad servers, Alphabet has expanded its reach and made it harder for rivals to build the scale needed to challenge its integrated stack. Over time, these self-reinforcing loops have reduced competition and harmed efficiency. Publishers risk missing out on better deals when they are forced to use Alphabet's unified platform, which can lower advertising revenues and reduce the supply of ad-funded content. Advertisers may also face higher intermediation fees, which may eventually lead to higher prices for consumers. In addition, barriers to entry and expansion have likely stifled innovations that competitive pressure might otherwise have spurred.

Fig. 3 maps Alphabet's four major leveraging practices (discussed in Section 3) onto the layers of the ad tech value chain. Although each practice has its own technical features, they share two core conflicts of interest. First, *unequal access to supply* occurs

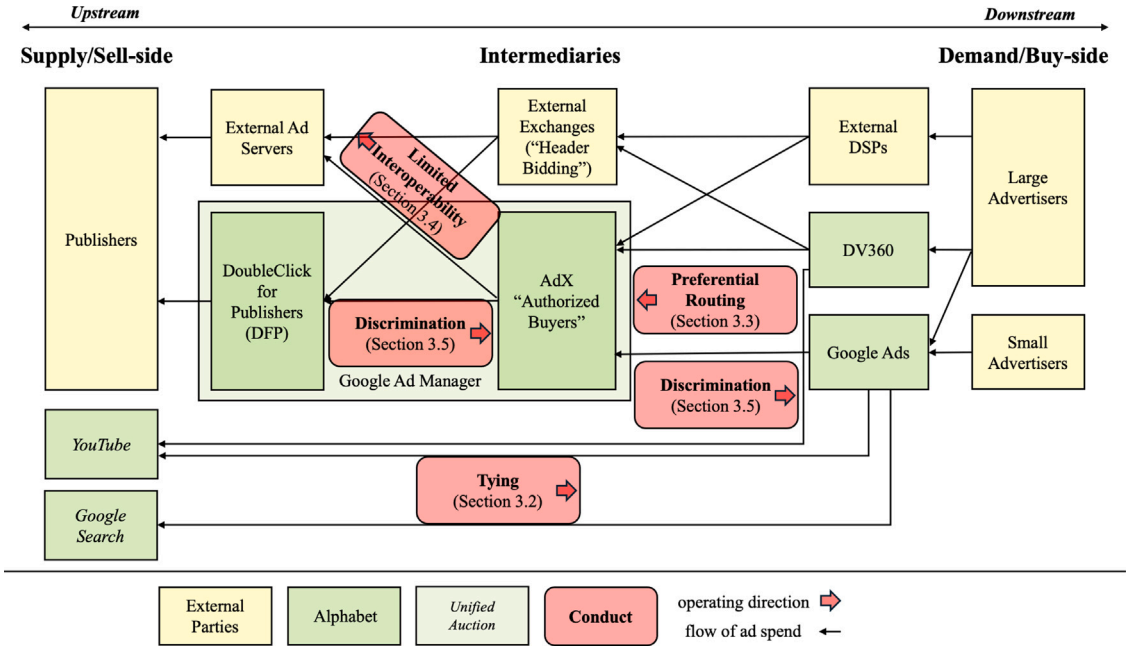


Fig. 3. Leveraging conducts of Alphabet mapped to interaction layers in the ad tech value chain, with indicators for their operating direction (upstream or downstream).

when Alphabet's control over consumer-facing inventory (e.g., *YouTube*, *Search*) or its ad server discriminate against rival DSPs and exchanges. Second, *unequal access to demand* arises when Alphabet's DSPs or exchange are not equally interoperable with upstream rivals.

We now turn to potential remedies in Section 4. First, we explore behavioral measures to halt the offending conduct, and then we examine how structural interventions could reduce the incentive for such practices by reconfiguring Alphabet's ownership across adjacent layers.

4. Remedies to promote competition in ad tech

Designing remedies to promote competition involves complex legal, economic, and practical challenges. Article 7(1) of Regulation 1/2003 of the European Union provides the legal basis for imposing remedies, stating that the European Commission "may impose on [infringing parties] any behavioral or structural remedies which are proportionate to the infringement committed and necessary to bring the infringement effectively to an end". Two guiding principles apply: *effectiveness* and *proportionality* (OECD, 2022). Effectiveness requires stopping the infringing conduct, preventing its recurrence, and restoring competition in the market (Bostoen & van Wamel, 2023). Proportionality demands that remedies do not impose undue burdens on the infringing firm or other stakeholders (OECD, 2022).

Remedies for anticompetitive conduct can be broadly classified as behavioral or structural (Maier-Rigaud & Loertscher, 2020; OECD, 2022). Behavioral remedies restrict or ban specific actions without changing a firm's structure, while structural remedies aim to remove the incentive for repeated abuses by altering the firm's structure. In what follows, we first evaluate behavioral remedies that would prohibit Alphabet's offending conduct, and then consider structural remedies designed to eliminate Alphabet's ability to leverage market power across adjacent layers. Throughout, we weigh the trade-offs between these approaches.

4.1. Evaluation of behavioral remedies to address unequal access to inputs for downstream and upstream services

Behavioral remedies restrict or prohibit certain conduct (OECD, 2022). In ad tech, we focus on two types: *prohibitions* (for example, banning tying practices) and *access obligations* (such as requiring data sharing). Because these remedies mirror the specific infringement, they can be tailored to address particular concerns while minimizing disruption to efficient structures (Maier-Rigaud & Loertscher, 2020).

However, behavioral interventions require continuous oversight (OECD, 2006, 2022). Firms may gradually circumvent or weaken the rules, which places a heavy monitoring burden on authorities (Maier-Rigaud & Loertscher, 2020; OECD, 2022). These measures target observable behavior without removing the economic incentive for repeated abuses (OECD, 2006), leaving room for subtle or modified anticompetitive strategies.

Table 1
Overview of behavioral remedies to address discrimination in ad tech. The table categorizes abuses by a dominant supplier and a dominant buyer. Each abuse is operationalized in specific conduct, with corresponding remedies and their associated costs mapped to them in the same row. Behavioral remedies are divided into prohibitive measures, which prevent specific conduct (e.g., untying or data siloing), and access obligations, which mandate equal access to key inputs (e.g., inventory, auction data, or bids). Where a remedy or cost applies to multiple abuses, the corresponding entry spans multiple rows.

Abuses		Behavioral remedies			
		Prohibitions (Section 4.1.1)		Access obligations (Section 4.1.2)	
Type	Conduct	Remedy	Associated costs	Remedy	Associated costs
Dominant upstream supplier discriminates against downstream rivals	Tying inventory and data (Section 3.2)	Untying inventory	Multihoming costs for advertisers	Access to inventory and targeting data (e.g., *YouTube* via *Google Ad Manager*)	Creating or adapting technical standards: high for search; lower for display Defining economic access conditions: objective licensing criteria and pricing (potential mark-ups; zero-fee mandates for auction data) Intensive monitoring to prevent subtle or shifting discrimination
		Data siloing: user data	High enforcement costs to ensure genuine data separation Efficiency loss from less precise targeting		
	Discrimination by auctioneer (Section 3.5)	Data siloing: auction data	Persistent quality gap in bidding algorithms Intensive monitoring to prevent subtle or shifting discrimination	Access to auction data (e.g., MBTW)	
Dominant downstream buyer discriminates against upstream rivals	Discrimination by bidder: preferential routing (Section 3.3); lack of interoperability (Section 3.4)	(None: commercially infeasible to deny all sellers access to Alphabet's demand)	–	Provide equal access to DSP demand to external ad servers and exchanges (e.g., through header bidding)	

Access remedies, such as mandating interoperability between vertically adjacent layers, bridge behavioral and structural approaches (Ezrachi, 2006). They require the dominant firm to share resources fairly, but still demand extensive oversight (CMA, 2020d, p.3). For our purposes, we classify them as *behavioral* because they also need ongoing compliance monitoring.

As discussed in Section 3.6, Alphabet's leveraging practices raise two main concerns. First, its dominant upstream services (such as consumer-facing platforms and ad servers) give rivals unequal access to supply by tying inventory and data or by discriminating in auctions. Second, its dominant downstream services (such as DSPs or the ad exchange) provide rivals with unequal access to demand, for example through preferential routing or a lack of interoperability. Effective behavioral remedies should aim for an "equivalence of inputs" to address both issues, but they do so in different ways. When upstream services deny equal access to supply, either outright prohibitions (for example, untying *YouTube* from Alphabet's DSPs) or access obligations (such as interoperability requirements) may help restore balance. In contrast, for "unequal access to demand" a purely prohibitive approach, such as forbidding Alphabet's DSPs from linking with third-party supply, is commercially infeasible. In other words, while untying the DSP from exclusive rights to *YouTube* inventory is feasible, simply barring Alphabet's DSP from linking with outside supply would be neither practical nor desirable, as advertisers and publishers benefit from a broad pool of demand. Thus, for "unequal access to demand", the realistic solution is to ensure that Alphabet's downstream services do not discriminate among upstream intermediaries. Table 1 provides an overview of both prohibitions and access remedies that address the specific leveraging practices discussed in Section 3 and their associated costs.

4.1.1. Prohibitive behavioral remedies to address unequal access to inputs for downstream services

One way to counter Alphabet's leveraging practices is to use prohibitive measures that stop its direct foreclosure tactics. For example, untying *YouTube* or *Google Search* inventory from its DSPs would let rival DSPs compete on factors other than supply access. Enforcing data siloing would stop Alphabet from combining user data across its consumer services or using sensitive rival bidding data to skew competition. Likewise, requiring Alphabet to restore pre-2019 reserve price conditions instead of Unified Pricing Rules (UPRs) would let publishers set different prices for different demand sources at little cost. Together, these measures would encourage multihoming across demand sources and allow rival services to compete fairly.

The success of these prohibitive measures depends on effective enforcement, and the costs differ between untying and data siloing. Untying is relatively easy to monitor because Alphabet's first-party inventory is either available or not. In contrast, data siloing is hard to enforce because of the information asymmetry between tech companies and regulators (Krämer & Schnurr, 2022). Regulators would need ongoing access to Alphabet's backend systems to check that different data sets stay separate. This is even harder when machine-learning models or algorithmic pipelines reuse partial data or inferred signals, making complete isolation difficult to prove.

It is also very hard to verify that no new or modified discrimination appears in real-time auctions. The ad tech ecosystem runs trillions of auctions each year with complex decision algorithms that even advertisers and publishers struggle to track (ISBA, 2020, 2023). Even with standardized auction logs or universal transaction IDs (ACCC, 2021, p.167), regulators must analyze vast amounts of data to tell apart normal optimizations from covert discrimination. Every time Alphabet updates its services, there is a risk that discriminatory behavior might reappear, forcing regulators into constant audits or the use of specialized forensic teams.

In short, while measures like untying can be monitored with routine checks, enforcing data siloing and ensuring nondiscrimination in real-time auctions is a continuous and resource-intensive effort. These high monitoring costs may reduce the overall benefit of purely behavioral remedies, as regulators are forced to keep catching up with multiple complex and opaque ad tech platforms.

Moreover, prohibitive remedies such as untying and siloing can disrupt legitimate economies of scope (see Section 3.2.3). If advertisers must split campaigns across multiple DSPs to cover Alphabet's consumer services, they face extra complexity in measurement, frequency capping, and audience targeting. No single DSP can combine *YouTube* with other display sources under one unified user-identifier system. This leads to extra work in matching service-specific IDs and can cause errors (see Section 3.2). One possible solution is to adopt industry-wide user identifiers to streamline targeting and measurement (CMA, 2020d, p.25), but this requires wide publisher adoption and faces privacy and consent challenges (Schiff, 2021).

Finally, even if prohibitive measures stop Alphabet's explicit discriminatory practices, they do not fix the competitive imbalance from its historical data advantages. Long-term access to rival bidding data has allowed Alphabet to refine its bidding algorithms, giving its DSPs a lasting quality edge. This means that even after data siloing, Alphabet's DSPs may still win auctions through "smart bidding" due to superior predictive accuracy. Without additional measures to level the playing field, prohibitions alone risk locking in Alphabet's dominance by preserving its accumulated informational lead. Thus, restoring competition effectively requires access remedies that actively rebalance conditions. Rival DSPs or ad exchanges bidding in *Google Ad Manager* must be able to access comparable data.

4.1.2. Access remedies to address unequal access to inputs for downstream and upstream services

Vertical interoperability requirements offer an effective alternative to prohibitive measures. In practice, this means that rival downstream services, namely DSPs and/or ad exchanges, would receive nondiscriminatory access to Alphabet's consumer-facing inventory (e.g., *YouTube* and *Google Search*) and its associated data. Moreover, would compete under the same auction rules as Alphabet's own services when bidding for third-party inventory offered through *Google Ad Manager*. Similarly, upstream interoperability mandates would require Alphabet's buy-side services (*Google Ads* and DV360) to submit bids on equal terms to *Google Ad Manager* as well as to rival upstream services such as ad exchanges and ad servers. In both instances, vertical interoperability would promote multihoming, thereby enhancing competition in the markets for DSPs, ad exchanges, and ad server providers.

Compared to prohibitive measures like untying or data siloing, interoperability requirements preserve the economies of scope that arise from vertical integration (Krämer & Schnurr, 2022). Instead of eliminating these efficiencies, they extend them to competitors, potentially improving overall welfare. However, implementing interoperability mandates requires not only effective enforcement but also careful consideration of both technical and economic conditions. Regulators must decide *how* access should be granted (technical conditions) and determine *to whom* and on *what terms* such access should be provided (economic conditions) (Bourreau et al., 2022).

4.1.2.1. Technical access conditions: Access operationalization. Defining technical access conditions means deciding how much control Alphabet keeps over the design of interfaces for rival services. Allowing full autonomy lets Alphabet innovate quickly but risks subtle sabotage, such as frequent changes in specifications, limited API endpoints, or reduced service quality. In contrast, a multi-stakeholder approach, in which regulators, third parties, and industry participants jointly define and monitor interoperability standards, can reduce these risks, though it may slow development.

In ad tech, many existing protocols for vertical interoperability can help lower the cost of developing new standards. For example, to promote equal access for downstream services, Alphabet could be required to sell *YouTube* inventory through the unified *Google Ad Manager* auction, as it did before 2015 (Mohan, 2015). The user-level data needed for targeting would be shared under controlled protocols, allowing external DSPs to compete effectively. Although Alphabet argues that adapting *YouTube*'s 'TrueView' ad format for real-time bidding would be costly and violate data-protection laws, the CMA (2020d, pp.35–36) challenges these claims. In principle, *YouTube* could adopt existing programmatic standards or implement an API that lets external DSPs run comparable skippable ads while respecting privacy laws, much like Alphabet handles third-party publisher inventory. Nonetheless, authorities must guard against potential sabotage since Alphabet might still withhold its most valuable *YouTube* impressions or degrade the interface (Cross, 2022), which would require continuous transparency and oversight.

Technical interoperability for *Google Search* inventory is more difficult. No open standard exists for query-based advertising, and developing one would be costly for both Alphabet and its rivals. Therefore, it may be more proportionate to prohibit tying *Google Search* inventory to Alphabet's DSPs and to enforce data siloing so that sensitive query data cannot be used to foreclose competition in the DSP market (see Section 4.1.1). In other words, if building a shared protocol for *Google Search* is too burdensome, simpler prohibitive measures can still address the tying concern.

Beyond inventory and data access, regulators should require that Alphabet's internal *Google Ad Manager* auction applies identical rules and data fields for all demand sources. Alphabet has introduced a MBTW feature to share price-to-beat information with participating DSPs, but external bidders currently lack the means to use it effectively (see Section 3.5). Leveling these conditions would allow rival DSPs or ad exchanges to calibrate their bids based on the distribution of the highest and second-highest bids, helping them bid with the same precision as Alphabet's own services (i.e., replicate "Smart Bidding").

For upstream interoperability, Alphabet's buy-side services (*Google Ads* and DV360) should be required to submit bids on neutral terms to external ad exchanges and ad servers. If Alphabet's DSPs systematically underbid in external exchanges (as in "Project Poirot"), publishers become locked into *Google Ad Manager* for the highest net bids (see Section 3.3.2). Mandating that Alphabet's DSPs submit bids to established header bidding solutions (e.g., *Prebid* or Amazon's server-side solutions) could simplify upstream interoperability without needing to create new protocols.

With respect to enforcement, the challenges remain significant. Regulators must parse large datasets, ensure compliance with access protocols, and guard against covert discriminatory practices in bidding or data sharing. For upstream vertical interoperability, it is especially difficult to differentiate between benign optimizations (like bid shading), natural vertical synergies that lead to higher bid success rates on integrated services, and deliberate strategic discrimination (such as slow or low bidding). These factors further increase the costs of enforcement.

4.1.2.2. Economic access conditions: Access licensing and pricing. Even with robust technical frameworks, it is crucial to define who receives access to Alphabet's inventory and data, and under what terms. Without clear licensing criteria or coherent pricing rules, Alphabet might still engage in subtle discrimination, such as denying access under vague safety or privacy claims or imposing cost structures that block smaller rivals.

Licensing should be based on objective, verifiable standards. For instance, rival DSPs could be required to show compliance with established brand-safety guidelines and user-consent frameworks, mirroring the obligations that Alphabet already imposes on its own DSPs. Industry organizations like the International Advertising Bureau (IAB) could lead a multistakeholder process to define these criteria, leaving regulators to step in only when complaints of unfair licensing practices are substantiated.

In addition to concerns for downstream rivals, when Alphabet sells inventory from its consumer-facing services through *Google Ad Manager*, it has an incentive to discriminate against upstream rivals, namely, external publishers competing for the same advertiser demand. For example, Alphabet might revoke licenses on arbitrary grounds, delay access to key features, or create technical barriers that reduce a publisher's visibility and revenue potential. Similar issues have been observed in other platform markets, where Amazon and Apple have faced criticism for favoring their own products over third-party competitors (Roth, 2024; Smith, 2022).

Pricing is equally critical. Access fees must balance the promotion of market entry with Alphabet's need to recoup its investments, such as for brand-safety features on *YouTube* or developing access points. A balanced pricing regime might set moderate mark-ups over direct costs, ensuring that fees cover necessary investments without imposing excessive barriers on smaller rivals. In certain cases, such as with historical bid data or auction logs, a zero-price regime may even be justified if those datasets were acquired through past anticompetitive conduct. For access to *YouTube* inventory and associated user data, a regulated, cost-based "access price" may not be essential in a fully open, real-time auction setting. If all DSPs receive the same callouts, user signals, and timing, the final clearing price for each impression should naturally reflect the value of *YouTube*'s brand-safety or content-moderation investments. Advertisers willing to pay a premium for a secure, engaging audience would express that in their bids, allowing *YouTube* to recoup its investment through higher auction outcomes rather than fixed fees.

However, this approach depends on Alphabet not withholding valuable impressions or imposing subtle disadvantages, such as strategic latency or reduced data granularity, that favor its own buy-side tools. Regulators must focus on equivalent access to inventory, user and post-auction signals, and enforcing non-discriminatory auction rules. If these safeguards are effectively enforced, market forces can compress each bidder's margin in the *Google Ad Manager* auction, enabling *YouTube* to capture fair returns through the auction itself. In this scenario, a separate regulated "access fee" becomes unnecessary, as a robust, multihoming-friendly auction process would determine price without covert sabotage.

4.2. Evaluation of structural remedies in ad tech

While behavioral measures can effectively limit specific abuses, they require ongoing oversight and do not remove the fundamental incentive to leverage market power. In contrast, structural remedies change a firm's ownership or operational structure so that the underlying conflict of interest is eliminated in the future (Maier-Rigaud & Loertscher, 2020; OECD, 2006, 2022).

Structural interventions vary in their intrusiveness and scope. The least intrusive method from a property rights perspective is accounting separation, where the firm maintains separate financial statements for different business lines (BEREC, 2011). Although accounting separation can help detect transfer-pricing abuses, it cannot address non-price discrimination, such as preferential routing or discriminatory data sharing, since integrated divisions may still coordinate tactics or leverage proprietary data. Therefore, accounting separation offers limited effectiveness in ad tech, where the multiple issues concern non-price discrimination and leveraging.

For these reasons, we do not consider accounting separation an effective structural remedy in this context. Instead, we focus on more intrusive measures, such as functional separation and ownership separation. Table 2 provides an overview of these two approaches, mapping specific abuses to the corresponding structural remedies and their associated costs.

4.2.1. Functional separation: Effectiveness and costs to remove buy-side and sell-side conflicts

Functional separation requires that a firm divides its operations into distinct business units that operate as if they were independent. In practice, this means that each unit has its own management team, its own performance incentives, and strict firewalls that prevent sharing of data, processes, or commercial decisions with other units (BEREC, 2011; Gilbert, 2021). The goal is to discourage one unit from favoring another and to have each branch focus solely on its own profit.

In the ad tech context, Alphabet would need to restructure its buy-side services (DSPs) and sell-side services (ad exchanges and ad servers) into separate units. Under this model, each unit could work with external partners on its own terms. For example, a DSP would be free to form new relationships that boost its revenues rather than feeling compelled to route volume to Alphabet's own exchange. However, the success of this approach depends on strong oversight to ensure that managers do not collude or bypass the separation rules.

To achieve true functional separation, regulators would have to closely monitor management agreements and daily operations. This oversight would include reviewing hiring practices, compensation schemes, and compliance records, as well as monitoring data

Table 2
Overview of structural remedies to address discrimination in ad tech. The table categorizes abuses by a dominant supplier and a dominant buyer. Each abuse is operationalized in specific conduct, with corresponding remedies and their associated costs mapped to them in the same row. Structural remedies are divided into ownership separation (with two options) and functional separation. Accounting separation is not included here, as it offers limited effectiveness against non-price discrimination. Where a remedy or cost applies to multiple abuses, the corresponding entry spans multiple rows.

Abuses		Structural Remedies			
		Functional (Section 4.1.1)		Ownership (Section 4.1.2)	
Type	Conduct	Remedy	Associated costs	Remedy	Associated costs
Dominant upstream supplier discriminates against downstream rivals	Tying inventory and data (Section 3.2) Discrimination by auctioneer (Section 3.5)	Separate management for buy-side and sell-side divisions under unit-specific incentive schemes to limit maximization of joint profit Enforce strict firewalls for data and operations to discourage discrimination	Auditing contracts and incentive schemes to confirm genuine separation Defining and monitoring technical and economic access conditions if separated units seek interoperability Intensive monitoring to prevent subtle or shifting discrimination Persisting "wooden dollars" problem	Option A: Divest all sell-side functionality: *Google Ad Manager*; *YouTube*, *Google Search* Option B: Divest all buy-side functionality: *DV360*; *Google Ads*	Intrusive to property rights, especially when divesting services developed in-house (e.g., Option A: *Google Search*; Option B: *Google Ads*) Reorganization: low for personnel; higher for infrastructure Double marginalization Loss of efficiencies: targeting; multihoming cost for advertisers; technical synergies
Dominant downstream buyer discriminates against upstream rivals	Discrimination by bidder: preferential routing (Section 3.3); lack of interoperability (Section 3.4)				

and inventory transfers to ensure that all interactions with rival platforms occur on equal terms (CMA, 2020d). Even with these measures in place, extensive audits would be needed to verify that no unit secretly benefits an affiliate or violates fair-dealing rules with external partners.

A further challenge for functional separation is the so-called "wooden dollars" problem (Feasey & Krämer, 2019). Even if internal divisions are required to charge each other for access, these transactions occur within the same firm. For instance, an integrated DSP might bid higher or charge lower fees when dealing with the parent's ad exchange because any cost is offset by profits in that division, a tactic that independent competitors cannot replicate without incurring real losses. In this way, functional separation does not recreate the competitive discipline that exists among completely separate firms.

In short, while functional separation attempts to add organizational firewalls on top of behavioral rules to curb discrimination, it does not fully eliminate the incentive to leverage market power that arises from common ownership. Although more intrusive than simple behavioral rules, functional separation offers little additional benefit if it ultimately depends on the same rigorous monitoring. Alphabet, as a parent company, could still profit from steering business to its own units, so the cost of implementing functional separation may outweigh its gains. Consequently, it remains uncertain whether operational separation alone in ad tech can materially improve on the protections provided by a well-enforced behavioral regime.

4.2.2. Ownership separation: Effectiveness and costs to remove buy-side and sell-side conflicts

Ownership separation, achieved through divestiture, is a more decisive structural remedy. This approach forces the dominant firm to sell certain business units outright so that it can no longer coordinate strategies across the value chain (OECD, 2006, 2022). By eliminating common ownership, divestiture reduces monitoring costs because the firm loses the profit motive to discriminate against services on adjacent layers (Maier-Rigaud & Loertscher, 2020). Although ownership separation may disrupt legitimate efficiencies, it offers a robust means to realign incentives and restore competition in an industry where anticompetitive practices are driven by vertical integration.

Effective ownership separation in ad tech requires that Alphabet no longer operate both buy-side and sell-side functionalities under one corporate umbrella. The core conflict of interest arises because Alphabet advises advertisers on the buy side while managing or owning publisher inventory on the sell side. This dual role creates incentives to favor its own services, limit multihoming, and foreclose rivals. Ownership separation removes these incentives by restructuring the firm (Maier-Rigaud & Loertscher, 2020; OECD, 2006, 2022). To design an effective divestiture, it is important to map out Alphabet's buy-side and sell-side functionalities and identify where conflicts occur.

On the buy side, both DSPs and ad exchanges perform purchasing functions. DSPs buy inventory from ad exchanges, and ad exchanges, in turn, acquire inventory from ad servers. On the sell side, ad servers and ad exchanges facilitate inventory sales. Since the 2019 unified auction (where *AdX* was folded into *Google Ad Manager*), Alphabet competes as a buyer only through its DSPs, while it operates *Google Ad Manager* as a sell-side service. Moreover, Alphabet runs sell-side services as a publisher through platforms like *YouTube* and *Google Search*. These platforms generate inventory that Alphabet could continue to operate even if it divested from its buy-side functions.

Two options for effective ownership separation emerge. In Option A, Alphabet would be confined to operating buy-side functionalities, while in Option B, it would operate only sell-side functionalities (including its role as a publisher). Either option could eliminate the incentive for anticompetitive leveraging.

Although splitting integrated assets can remove the root incentive to discriminate and reduce enforcement costs, critics argue that breakups are too disruptive because disentangling deeply integrated assets is costly. Kwoka and Valletti (2021) counter that such costs of "unscrambling the eggs" are often overstated, pointing to real-world precedents in telecom and energy industries where breakups have been both feasible and effective. The key question is whether the structural remedy yields greater pro-competitive benefits at the lowest social and economic cost compared to alternatives like perpetual regulatory oversight or tolerating abusive behavior.

When determining which parts of the business to divest, past mergers and acquisitions can offer convenient "fault lines" that restore pre-acquisition market structures (Kwoka & Valletti, 2021). However, forced divestitures invariably intrude on property rights. The distinction between Option A (divesting *Google Search*, *YouTube*, and other sell-side services) and Option B (divesting the buy-side, including *Google Ads* and DV360) does not map neatly onto in-house versus acquired operations. Both *Google Search* and *Google Ads* were developed internally, while *YouTube*, DV360, and *Google Ad Manager* come from acquisitions (DOJ, 2023, pp.34–35). Thus, enforcers must assess which grouping is most central to Alphabet's business model and which option best restores competition.

Divestiture brings several cost categories. First, there are short-term reorganization expenses, such as reassigning engineering teams and reconfiguring shared systems. However, because Alphabet's buy-side and sell-side divisions already have distinct personnel and office locations (CMA, 2020d, p.7), separating human resources might not be overly burdensome. But both option A and B would still require disentangling shared infrastructure that was optimized for vertical integration.

Second, structural separation may create double marginalization. This occurs when an upstream firm charges a price above cost, and a downstream firm treats that price as its own cost and adds another markup (see,e.g., Tirole, 1988). Both markups raise the final price paid. In ad tech, if a DSP and an ad exchange split apart, each might set its own 'markup' to the publisher, reducing the net payout. The DSP could shade advertiser bids, and the exchange could add transaction fees. Competition at each layer keeps these markups in check. By contrast, double marginalization does not appear in the ad server layer. An ad server usually charges on a per-impression or volume basis (DOJ, 2023, p.22). These fees do not change when DSPs or exchanges adjust their markups on

a particular transaction. As a result, the ad server layer does not create another markup, so classic double marginalization does not occur there.

Third, vertical divestiture disrupts synergy gains. Splitting the DSP from consumer-facing services reduces the one-stop-shop convenience and the cross-use of user data from high-traffic services (see Section 3.2.3). Similarly, separating the DSP from the ad exchange eliminates technical integrations like shared user identifiers and co-located infrastructure that help targeting and reduce latency (see Section 3.3.3). Either option would forgo these operational efficiencies, diminishing some benefits for advertisers and publishers. In this light, the key question is whether the lost synergies primarily serve to entrench foreclosure or genuinely enhance competition and consumer welfare. Given that foreclosure appears to dominate, structural remedies that restore competitive pressure may justify the loss of some efficiencies.

4.3. Proportionality and policy recommendations

When judged by the principle of proportionality, which demands both effectiveness and the avoidance of undue burdens, purely behavioral remedies in the ad tech stack appear insufficient to address Alphabet's persistent conflicts of interest. Continuous oversight of real-time auctions, data siloing, and nondiscrimination rules would impose heavy monitoring costs while leaving intact Alphabet's incentive to favor its own buy-side and sell-side services. Even proposals for universal transaction IDs or standardized logs, though useful for reconstructing impression routing and pricing, would not eliminate the underlying incentive to discriminate. Subtle algorithmic biases, frequent system updates, and enormous data volumes would still present regulators with a perpetual cat-and-mouse challenge. Similarly, obligations to share user data or enforce interoperability protocols would require complex standards, careful pricing controls, and constant audits in an opaque and volatile environment.

Consequently, a narrower structural remedy appears better suited to address the root conflict. Although more intrusive in principle, an ownership separation can be proportionate if it (1) directly targets Alphabet's documented foreclosure incentives, (2) is feasible without unduly disrupting its core operations, and (3) delivers social benefits that outweigh the loss of some efficiencies.

Effective ownership separation means that Alphabet would no longer simultaneously advise advertisers (buy side) and publishers (sell side). Once split, the firm's incentive to favor its own downstream or upstream services would vanish because it would no longer own both sides of the transaction. Schinkel and van Oosten (2024) argue for "smart cuts" into Alphabet and other big tech companies, that separate a platform's "advisory" functions (e.g., dominant consumer-facing services such as *Search*, *YouTube*, or *Maps*) from services that compete for consumer demand, on the premise that such integration inherently biases consumer choices. As discussed in Section 4.2, we agree that this general principle of decoupling a dominant advisory platform from complementary functionalities is sound, as it removes the platform's incentive to favor its own adjacent services. However, in ad tech specifically, a focus on consumer-facing media alone is insufficient. Even if *Google Search*, *YouTube*, or *Maps* were spun out as separate services, the core competition concerns around how advertisers buy inventory and how publishers access demand would persist. In ad tech, the advisory role over advertisers as buyers belongs primarily to DSPs (and partly ad exchanges) and not to consumer-facing platforms. Thus, fully separating *YouTube* or *Search* from the rest of Alphabet does not by itself cure the conflicts of interest that hamper ad tech markets, unless the selling (ad server-ad exchange suite) and buying (DSP) sides are fully disentangled. However, full divestiture of all sell-side services including *Google Search* and *YouTube*, along with *Google Ad Manager* is a needlessly intrusive approach. While it would ensure unbiased intermediation it comes at the cost of dismantling Alphabet's core consumer-facing operations.

A straightforward approach to eliminating Alphabet's conflict of interest would be a full buy-side divestiture, requiring the company to sell both DV360 and *Google Ads* and permanently exit the DSP market. This would ensure that Alphabet no longer has the ability to steer ad spend or leverage its market power as both a buyer and a seller. However, such an approach would impose unnecessary costs by removing Alphabet's primary tool for selling its own proprietary inventory, such as *Google Search* and *YouTube*, forcing the firm to develop an entirely new sales interface for its own properties. Since *Google Ads* was originally designed as an in-house tool for selling search ads, divesting it would likely not only be costly but also inefficient, as Alphabet would need to reinvest in replicating a function it already provides.

Instead, Fig. 4 illustrates a targeted structural remedy that balances effectiveness and proportionality. Alphabet must fully divest DV360, as indicated by the scissor-line in Fig. 4. Meanwhile, *Google Ads* remains under Alphabet's ownership but is strictly limited to selling only Alphabet's first-party inventory. In Fig. 4, a hammer blow signifies the elimination of *Google Ads*' ability to buy third-party display inventory, effectively ending its role as a general-purpose DSP. Together, these interventions ensure that Alphabet no longer operates a DSP that competes for third-party supply and removes its incentive to discriminate against independent rivals in auctions run by *Google Ad Manager*. Moreover, it ensures that Alphabet cannot use *Google Ads* to steer advertiser budgets toward its own supply-side services at the expense of rivals.

This proposal effectively removes Alphabet's ability to distort competition in the ad tech ecosystem. Alphabet's first-party inventory is no longer accessible through a DSP that competes with independent rivals, eliminating unfair advantages in the DSP market. Alphabet can no longer use its control over advertisers' buying decisions to direct ad spend toward while foreclosing rival exchanges and ad servers. Alphabet also no longer operates a buy-side service that competes in auctions run by its own sell-side service, removing any incentive to engage discriminatory treatment in auctions. At the same time, this proposal remains proportional because it allows Alphabet to retain its core consumer-facing operations while maintaining a specialized, first-party sales channel, rather than forcing the firm to rebuild that capability from scratch. Unlike a full buy-side divestiture, which would require Alphabet to develop a new in-house system for selling search and *YouTube* ads, this solution preserves existing efficiencies without sacrificing competitive neutrality.

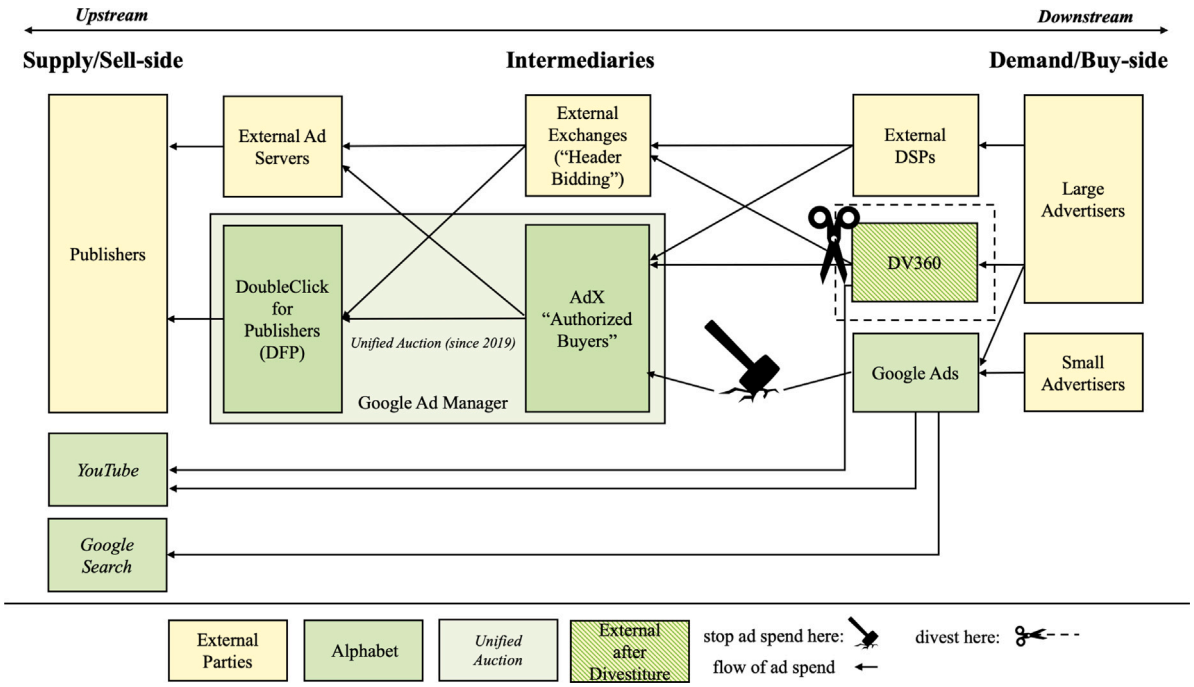


Fig. 4. Proposed proportionate policy intervention to remedy conflicts of interest in ad tech. Separate all buy-side functionality from sell-side functionality. Remove Alphabet as a competitor in its sell-side auctions by divesting *DV360* (illustrated by scissor-line cut) and by removing access to *Google Ad Manager* for *Google Ads* (illustrated by the hammer blow on the flow of ad spend). Restrict access to proprietary supply of *YouTube* and *Search* to *Google Ads* exclusively.

Despite these advantages, there are still a few caveats to protect against Alphabet affecting the effectiveness of the policy. First, although restricting *Google Ads* from serving third-party inventory prevents Alphabet from steering advertiser budgets to its own services, regulators must confirm that *Google Ad Manager* does not route external impressions to *Google Ads*. This should be fairly easy to monitor, since auditors can verify whether *Google Ad Manager* sends bid requests to *Google Ads* for third-party supply. Compared to more complex non-discrimination rules requiring ongoing audits of bidding algorithms, verifying that no requests are sent should be a straightforward technical check. Second, it should be monitored that Alphabet does not launch a new DSP to reenter the third-party buy side; doing so would recreate the very conflict of interest this remedy aims to solve. Like the first measure, this prohibition is easy to enforce by tracking newly registered DSPs or acquisitions. Lastly, there is a risk that Alphabet ties its first-party user data (from *YouTube*, *Search*, etc.) to *Google Ad Manager*, reinstating a bottleneck that forecloses competing ad servers lacking similar user data. Still, we expect any data-related edge alone to be weaker than the currently existing combined leverage of buy-side dominance plus data.

Moreover, although this proposal is less intrusive than a full breakup, ownership separation inherently imposes certain costs on advertisers and publishers (see Section 4.2.2). First, there may be an inefficiency cost due to double marginalization. However, we argue that this is low and negligible. Alphabet would retain its ad server and ad exchange but divest its DSP DV360. One might worry that double marginalization increases DSP bid shading and ad exchange fees after separation. Yet we expect the opposite. All DSPs would face greater competition, so bid shading should reduce, generating higher net bids. Alphabet's ad exchange would also lose leverage from its own DSP's demand, weakening its bargaining power. Meanwhile, the ad server charges a flat volume-based fee that does not depend on the exchange or DSP markups, hence there is no risk of double marginalization at that layer. Although *Google Ad Manager* may remain dominant due to the naturally high switching costs for publishers, it already charges a near-monopoly price given its market status (see Section 2). With DV360 spun off and *Google Ads* not competing in its sell-side auctions, Alphabet's leverage over ad serving should decrease, pushing overall fees down rather than up.

Second, ownership separation inevitably disrupts certain vertical synergies, thereby raising transaction costs in specific operational contexts. For instance, losing Alphabet's integrated infrastructure can diminish the low-latency advantages once enabled by co-located servers and introduce additional frictions stemming from the absence of shared user identifiers (see Section 3.3.3). To mitigate latency issues, regulators or industry bodies could promote co-location agreements between independent firms at fair market prices, mirroring arrangements in high-frequency financial trading (Srinivasan, 2020). Likewise, privacy-friendly universal user identifiers can replicate some of the targeting efficiency of a vertically integrated DSP and reduce error-prone identifier matching. Such identifiers also lower multihoming costs for advertisers by streamlining reporting and measurement across multiple DSPs (see Section 3.2.2). Both co-location agreements and universal user identifiers can help re-create these synergies for non-integrated providers, effectively making the benefits once reserved for vertically integrated firms more broadly accessible. Lastly, smaller advertisers might initially face higher hurdles (e.g., minimum-spend requirements) when moving to new or independent DSPs to

buy third-party display inventory. However, by removing *Google Ads* from direct competition for third-party inventory, the DSP market becomes more contestable, encouraging nascent entrants to offer DSP services explicitly tailored to smaller advertisers with budget constraints and limited technical sophistication.

This targeted approach ultimately removes Alphabet's ability to distort competition while avoiding the more disruptive impacts of a full-scale breakup. By separating the buy-side functions for third-party inventory, the remedy effectively severs the conflict of interest that arises when Alphabet competes in auctions managed by its own sell-side tools. At the same time, Alphabet retains a specialized channel for monetizing its consumer-facing platforms, preserving efficiencies and limiting undue intrusiveness. Hence, by balancing effectiveness and proportionality, this policy design addresses the core anticompetitive concerns without imposing unmanageable oversight or dismantling Alphabet's fundamental operations.

5. Conclusion

This paper highlights that Alphabet's vertical integration in the ad tech stack creates persistent incentives to foreclose rivals, which in turn undermines publisher revenues, stifles innovation, and harms consumer welfare. We examine how tying Alphabet's consumer-facing inventory and data, along with its discriminatory access rules, can be curbed through either behavioral or structural remedies, each carrying its own costs and benefits. Behavioral remedies offer a targeted intervention that preserves some efficiencies; however, in the opaque and multi-layered realm of real-time advertising, they demand intrusive oversight and are vulnerable to clever workarounds. By contrast, structural remedies, particularly ownership separation, realign incentives at a more fundamental level. Although such separation may sacrifice some legitimate data synergies or introduce issues like double marginalization, these costs may be justified when vertical integration leads to repeated foreclosure that is difficult to police.

Our analysis supports a structural solution in which Alphabet divests its buy-side operations while retaining its sell-side functionality, complemented by targeted behavioral measures. This combination would preserve valuable synergies for advertisers and publishers while removing the core conflict of interest that allows Alphabet to discriminate against rivals.

These findings also relate to the broader landscape of digital regulation. Ex ante regimes such as the EU Digital Markets Act (DMA) include provisions that nominally forbid many of the conducts related to 'hybrid platforms' that seek to gain an advantage against rivals on the respective platform which they operate. Yet the DMA's gradual escalation mechanism, moving from conduct obligations to, potentially, structural remedies in case of strategic non-compliance, may lag behind a rapidly evolving ad tech sector, especially if entrenched incumbents adopt partial compliance strategies or exploit information asymmetries. More decisive enforcement, including earlier recourse to structural measures, may thus be warranted where repeated circumvention is likely. Although such interventions inevitably entail transition costs, the alternative can be a 'cat-and-mouse' cycle of oversight that undermines the DMA's procompetitive goals.

Our study has limitations. First, our analysis is constrained by our reliance on publicly available datasets and regulatory disclosures. These data sources may not fully capture all internal dynamics of Alphabet's ad tech operations, particularly nuanced bidding strategies or proprietary algorithmic practices. Consequently, while our remedy design is robust based on existing evidence, access to more granular or proprietary datasets might further validate our recommendations or highlight specific operational details that could refine implementation. Second, relatedly, while we critically evaluate existing regulatory evidence, deeper economic modeling and empirical analyses, enabled by richer data, would help clarify the precise magnitude and broader implications of Alphabet's leveraging tactics on market outcomes.

Despite these caveats, our results highlight two key insights for policy. First, real-time digital advertising, with its complex layers of intermediation and bidding, presents oversight challenges that conduct rules cannot easily overcome. Second, while structural realignment is intrusive from a property rights perspective, it may be proportionate if it effectively resolves the underlying conflict of interest, especially when combined with carefully targeted behavioral measures that preserve beneficial efficiencies. By clarifying the relative merits, costs, and complementarities of these remedies, we inform regulators and researchers in developing durable frameworks that foster competition and innovation in digital advertising.

CRediT authorship contribution statement

Alexander Witte: Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Conceptualization. **Jan Krämer:** Writing – review & editing, Writing – original draft, Supervision, Funding acquisition, Formal analysis, Conceptualization.

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