

# Online advertising technology and competition



## Overview

- This POSTnote looks at online advertising technologies, competition challenges, and potential technological approaches to address these issues.
- Most online services earn revenue via adverts. Estimates suggest that online advertising is the fastest growing part of the advertising sector globally.
- Online advertising often relies on digital technology that manages auctions between advertisers and publishers.
- The UK's Competition and Markets Authority has found a lack of competition in digital markets, including online advertising.
- Harms to consumers that may arise from a lack of competition in online advertising include higher prices for goods and services, and excessive extraction of data.
- Factors such as unequal access to data can create advantages for large companies, for instance, if companies that offer targeted advertising use data collected about users on one platform to improve the targeting of ads to those users on their other platforms.
- The UK Government introduced the Digital Markets, Competition and Consumers Bill to help address competition issues in digital markets, including new regulatory powers.
- Measures to improve competition may raise issues for privacy and consumer protection, for example, if measures to address competition involve the sharing of personal data.

## Background

Most online services earn revenue via adverts (ads). Estimates suggest that online advertising is the fastest growing part of the advertising sector globally.<sup>1</sup> The UK advertising market is the third largest globally, based on advertising spend,<sup>2,3</sup> and contributed an estimated £21 billion to the UK economy in 2022.<sup>4</sup> Online advertising accounted for 75% of all UK advertising spend in 2022.<sup>5</sup>

Industry analysis indicates that online advertising is the primary revenue source for most online sectors, including search engines, social media, and other websites and apps, often allowing online services to be accessed without paying for them directly.<sup>6,7</sup> It can also help consumers discover new products and services, and businesses find new customers and markets.<sup>1</sup>

Online advertising is made possible by advertising technology (AdTech) that enables advertisers to deliver promotional materials to consumers.<sup>8</sup> Advertisers do this by buying advertising space (inventory) from publishers and online platforms, such as internet search engines, social media sites, websites and apps.<sup>8</sup> Typically, advertising space is sold via instantaneous auctions run by intermediary platforms or by publishers and platforms directly.<sup>8,9</sup>

In 2020, the UK's Competition and Markets Authority (CMA) said that competition in the online advertising market was not working well, causing "substantial harm" for consumers such as loss of innovation and choice, higher prices for goods and services, and limiting consumers' control of their data.<sup>10</sup> It concluded that new powers and a new regulatory approach were needed.<sup>10</sup>

The Information Commissioner's Office (ICO) and others have raised concerns about other potential harms from online advertising, in areas such as data and consumer protection.<sup>11-13</sup>

In 2020, UK regulators of online services formed the Digital Regulation Cooperation Forum,<sup>14</sup> comprising the CMA, ICO, Ofcom and the Financial Conduct Authority. This aims to help coordinate the approach to online services across regulators.<sup>15</sup>

In 2021, the UK Government outlined its plan for regulating digital technologies and in 2022 consulted on the Online Advertising Programme,<sup>1,16</sup> which aims to review the regulatory framework for paid-for online advertising. It has since announced plans for a new regulatory framework for online advertising to tackle illegal advertising and increase protection for under-18s.<sup>12,17</sup> The Government has also set up the Digital Markets Unit (DMU) within the CMA to promote competition in online markets.<sup>18</sup>

In 2023, the UK Government introduced the Digital Markets, Competition and Consumers Bill (see Commons Library Briefing [CBP-9856](#)).<sup>19,20</sup> This would give the DMU extra powers to address competition issues. Some stakeholders have raised concerns that the Bill gives the DMU excessive discretion and could lead to reduced innovation and investment.<sup>21,22</sup> The Bill may be carried over to the next parliamentary session.

# Online advertising technology (AdTech)

Many large technology companies own platforms that generate revenue from online advertising (Box 1).<sup>10,23</sup> These firms often sell advertising space on their own platforms, and may also provide advertising intermediation services that connect other publishers selling advertising space with the advertisers buying it.<sup>24</sup> Smaller platforms may compete with larger companies by offering services such as search engines (like Yahoo!) or social media platforms (such as Snapchat). In addition, thousands of smaller companies are involved in trading digital advertising, including The Trade Desk, Index Exchange, and Adform.<sup>25,26</sup>

Broadly, online advertising can be split into three categories:

- **Search advertising** – ads shown alongside search engine results.<sup>10,27</sup> This includes general search engines that aim to cover the entire internet (such as Google Search and Bing) and specialised search engines that cover a specific sector or platform (like Amazon Marketplace).<sup>28,29</sup>
- **Display advertising** – ads shown as videos, images or text on websites, apps, online newspapers or social media (such as YouTube, Facebook, TikTok and X – formerly Twitter).<sup>10,30</sup> Display advertising can be subdivided into open display (see page 4) and owned-and-operated (see page 6).<sup>10</sup>
- **Classified advertising** – includes listings on specialised websites such as Facebook Marketplace or Autotrader.<sup>10</sup>

## Box 1: Examples of major online platforms

Key companies in online advertising (with estimates of net digital advertising revenue worldwide in 2022),<sup>3</sup> include:

- **Amazon** (\$37.99 billion) – owns Amazon Marketplace, Prime Video and advertising intermediary services, and produces devices including Amazon Alexa, Amazon Fire TV and Kindle<sup>28,31</sup>
- **Apple** (\$7.06 billion) – owns the iOS operating system, and produces devices including computers, mobile phones and smart watches<sup>32,33</sup>
- **Google** (\$168.44 billion) – owns Google Search, YouTube, the Android operating system and advertising intermediary services<sup>34,35</sup>
- **Meta** (\$112.68 billion) – owns Facebook, Instagram, WhatsApp and advertising intermediary services<sup>36,37</sup>
- **Microsoft** (\$12.23 billion) – owns the Windows operating system, Bing Search, Xbox (console gaming) and advertising intermediary services, and produces mobile phones.<sup>38,39</sup>

## Search advertising

In search advertising, ads are targeted at users based on the terms they are searching for at that moment.<sup>40</sup> The ads shown, and their order on the page, are determined by an algorithm that ranks the ads according to factors such as how much the advertiser has offered to pay for advertising space associated with a specific search term, and ad relevance.<sup>40–42</sup>

Search advertising is the largest category of online advertising (by revenue), accounting for an estimated 50% of the UK online advertising market in 2022, compared to 14% for display (excluding social media), 26% for social media display, 4% for classifieds, and 6% for other formats.<sup>43</sup>

## Open display advertising

In open display, advertising space is sold to advertisers via direct deals, private marketplaces (such as invite-only auctions) or open auctions.

Open auctions are typically operated by a complex chain of third-party intermediaries that target ads based on available user data (Box 2) and other factors such as the time of day or relevance of an ad to the website's content.<sup>44</sup>

When a user opens a publisher's webpage (before the page displays), the webpage sends a request for an ad to the publisher's ad server<sup>44,45</sup> (Box 3), which ultimately determines the ads that appear. The publisher's ad server then sends a request to supply-side platforms (SSPs, Box 3), which manage and sell publishers' advertising space.<sup>44,46</sup> The SSPs send requests for advertisers' bids to multiple demand-side platforms (DSPs, Box 3).<sup>44</sup> DSPs are used by advertisers to assess the value of the advertising space they are being offered and to submit bids.<sup>47</sup> Bids are based on how likely the user is to engage with the ad based on available data (Box 2).<sup>48</sup>

SSPs and DSPs may connect directly or via an 'ad exchange', which brings large numbers of SSPs and DSPs together to buy and sell advertising space.<sup>49</sup> SSPs and ad exchanges may sell advertising space to 'ad networks', which aggregate it according to topics (such as "fashion") and sell it to advertisers.<sup>50,51</sup>

The DSPs send their bids back to the SSPs that requested them, and each SSP sends its winning bid to the publisher's ad server.<sup>44</sup> Winning bids are selected based on the bid amount and priority rules set by the publisher (for example, excluding blacklisted advertisers to protect brand reputation).<sup>44,52</sup> The publisher's ad server selects an ad to show, taking into account the bid amount and data about the user.<sup>44,45</sup> SSPs and DSPs may connect to data management platforms (Box 4).<sup>53</sup>

The path that ad requests and bids take can differ from the above. In header bidding for example, when a user opens a publisher's webpage, the browser simultaneously asks the publisher's SSP partners for bids directly, instead of via the publisher's ad server.<sup>44,54,55</sup>

## Box 2: Methods for collecting user data online

In display advertising, ads are targeted at users based on data collected through tracking of user activity.<sup>56,57</sup> Tracking technologies are also used to analyse the success of advertising campaigns.<sup>58</sup> When the processing of personal data is involved, it is subject to UK data protection law (see Commons Library briefings [CBP-9606](#) and [CBP-9803](#)).

### First-party cookies

These are used by websites to remember individual users.<sup>59</sup> When a user visits a webpage for the first time, the webpage deposits a short text file (a 'cookie') on their web browser that contains a unique ID and information about the user's device.<sup>60-62</sup> If the user returns to the webpage, the cookie is sent back to the webpage, enabling the user to be identified. First-party cookies enhance the functionality of websites, for example, enabling shopping baskets to be saved for later.<sup>60,62</sup>

### Third-party cookies

Websites may contain elements from third parties, which can be used to deposit cookies on a user's browser on behalf of the third party.<sup>62</sup> Third-party elements may include ads or social media buttons that allow users to 'share' or 'like' content on the page.<sup>63</sup> To display these elements, the user's browser needs to request them from the third party (such as a social media platform). The third party then places a cookie on the user's browser.<sup>62</sup> If a user visits multiple webpages containing elements from the same third party (for example, ads served by Google Ad Manager), then the third party can track the user across those pages.<sup>60</sup>

### Tracking pixels

Tracking pixels are transparent images that are one pixel in size, which record that a user has opened a webpage.<sup>64</sup> They can be used for:

- **Analysis of advertising campaigns** – by counting how many users open a webpage, the pixel can count how many times the ad has been viewed.<sup>65</sup> If a pixel is placed on a webpage on which an ad is shown, as well as all the pages involved in an online transaction, a causal link can be made between viewing an ad and making a purchase. This is used for analysing the success of advertising campaigns.<sup>66,67</sup>
- **Retargeting** – tracking pixel data can be used to show users ads for products they have viewed but not bought.<sup>68</sup>

### Box 3: Intermediaries in open display advertising

#### Advertiser's ad server

Advertisers who want to run an advertising campaign online use an ad server to store ads, manage their campaigns, and provide performance data.<sup>45</sup> In 2019, Google Ads and Google Campaign Manager had a 80-90% UK market share as a percentage of ads sold through open display.<sup>10</sup>

#### Publisher's ad server

Publishers use an ad server to decide which ads appear in each advertising space. They provide performance metrics for ads shown and forecast future availability of advertising space.<sup>45</sup> In 2019, Google Ad Manager, AdSense and Admob had a 90-100% UK market share of open display ads sold.<sup>10</sup>

#### Supply-side platforms

SSPs are used by publishers to sell advertising space. Initially distinct platforms, SSPs and ad exchanges (which bring SSPs and DSPs together to buy and sell advertising space) are now commonly integrated and the terms are often used interchangeably.<sup>44</sup> The functions of SSPs and publishers' ad servers can also overlap, with services such as OpenX providing an integrated SSP and ad server.<sup>46</sup> Google Ad Manager, AdSense and Admob all function as SSPs, and together had a 50-60% UK market share of open display ads in 2019, while Xandr (owned by Microsoft since 2021) had a 10-20% UK market share.<sup>10,69</sup>

#### Demand-side platforms

Advertisers use DSPs to bid for advertising space on publishers' websites. DSPs enable them to manage their advertising budgets and targeting strategies.<sup>44,47</sup> Google Ads functions as a DSP, along with Google's Display and Video 360 (DV360), and together these had a 40-60% UK market share of open display ads in 2019. The Trade Desk had the next largest DSP in 2019, with a 0-10% market share.<sup>10</sup>

### Box 4: Data management platforms (DMPs)

DMPs typically analyse anonymous user data from multiple sources (such as tracking pixels on a publisher's website) to collate user IDs into audience segments (such as "luxury watches").<sup>53,70</sup> DMPs are used by:

- **Advertisers**, who can target ads to relevant audience segments. DMPs perform "look-alike modelling", where the DMP finds user IDs that closely match the characteristics of an advertiser's best customers.<sup>53,71</sup>
- **Publishers**, who can use DMPs to understand the characteristics of their website visitors and use that data to sell their advertising space to advertisers more likely to engage with their content.<sup>53</sup>

## Owned-and-operated display advertising

Owned-and-operated display advertising refers to large platforms that sell their own advertising space directly to advertisers or their media buying agencies.<sup>10</sup> These platforms use their own AdTech and data obtained from users as they interact with their services.<sup>72</sup> Google runs its own integrated SSP and publisher ad server (Google Ad Manager<sup>73</sup>), and DSPs (Google Ads<sup>74</sup> and DV360<sup>75</sup>). Meta runs Facebook Ads,<sup>37,76</sup> via which advertisers buy ad space on Facebook and Instagram.

## Classified advertising

In classified advertising, advertisers place listings on specialised websites (such as Facebook Marketplace, Craigslist or Autotrader) usually paying fees or commission.<sup>10,24</sup> These often function as specialised search engines: users search for products and can choose to rank them by factors such as relevance or price.<sup>29</sup>

## Challenges for competition

The CMA estimated that, in 2019, Google generated over 90% of UK search advertising revenues, while Facebook Inc. (now Meta) generated over half of UK display advertising revenues.<sup>10</sup> Industry analysis estimated Google's share of UK search advertising revenue to be 70.7% in 2019 and 72.5% in 2022, while Meta's share of UK display advertising revenues fell from 50.3% in 2019 to 45.6% in 2022. TikTok's share of UK social media advertising revenue was estimated to have more than doubled from 3.7% in 2021 to 9.0% in 2022.<sup>3,77</sup>

Key factors that influence digital advertising revenues include the ability to capture consumers' attention, and access to data that enables more effective ad targeting.<sup>10,78,79</sup>

Publishers are typically paid every time an ad is displayed or clicked,<sup>80</sup> enabling platforms to make more revenue if they have more users, or users who spend more time on the platform.<sup>78</sup> Platforms also collect data about users' activities, such as preferences, purchasing intent and behaviour (Box 2), that can be used to target ads more effectively.<sup>81</sup> This may make advertising on large platforms more appealing to advertisers, especially when sold through an owned-and-operated system that has access to user data for ad targeting.<sup>72,82</sup> In open display advertising, intermediation services offered by large technology companies may be more appealing than services offered by smaller companies, for example due to ad targeting made possible by the user data available to these companies.<sup>10,83</sup>

The CMA identified several harms to consumers that may arise from a lack of competition in online advertising, including higher prices for goods and services and excessive extraction of data.<sup>10</sup> It concluded that lack of competition in online advertising is driven by market effects that favour companies with already popular platforms.<sup>10</sup> Market effects include:

- **Economies of scale** – developing and maintaining search and social media platforms involves significant investment and fixed costs, creating barriers to new market entrants.<sup>10,84</sup>

- **Network effects** – search and social network platforms are improved as the number of users increases.<sup>10</sup> As more people use a search engine, it collects more click and query data (the terms people search for and the results they click on), enabling it to improve its algorithms to generate more relevant results.<sup>78</sup> Similarly, social media platforms are more appealing if users can use them to connect to friends and family who are also users.<sup>10,84,85</sup>

## Concerns raised by competition regulators

The CMA, and other competition regulators internationally, are concerned about technology companies' conduct in specific cases that relate to online advertising.<sup>86–95</sup> For example:

- **Apple** – Apple's app tracking transparency policy mandates that software applications on Apple devices must ask users for permission to "track" them.<sup>96</sup> This prompt is not shown for Apple apps; however, users are asked whether they want to receive "personalised advertising" from Apple.<sup>97</sup> The CMA suggested that, although these prompts bring privacy benefits for users, their design makes it more likely users will opt out of tracking by third-party apps, but not Apple apps.<sup>97</sup> This may undermine app developers' abilities to monetise apps through advertising, and could encourage developers to adopt other means of monetisation, such as in-app purchases (from which Apple takes 30% commission).
- **Google** – Google's Privacy Sandbox has the stated aim of developing tools that enhance privacy on its web browser, Chrome. It seeks to enable targeted advertising (and other "cross-site use cases") without third-party cookies or other tracking. Google plans to phase out support for third-party cookies in Chrome from 2024.<sup>98–100</sup> Google has access to lots of first-party data from its other platforms.<sup>10</sup> The CMA has said that it would be concerned if Google could gain an advantage from these changes, for example by removing functionality currently provided to competitors through third-party cookies while retaining similar functionality for itself.<sup>101</sup> With the involvement of the ICO, the CMA has agreed legally binding commitments with Google under which it will oversee the implementation of the Privacy Sandbox changes to address competition concerns.<sup>102</sup> In addition, the CMA and the European Commission are running ongoing investigations into whether Google might have abused a dominant position through its conduct in the AdTech market.<sup>103,104</sup>
- **Meta** – Meta is being investigated by the European Commission and CMA to see whether Facebook uses data from online advertising to favour its own services. For example, if Facebook uses data from campaigns run by classified advertising companies on Facebook's social media platform to benefit Facebook Marketplace.<sup>105,106</sup>

## Using technology to improve competition

Ways to increase competition in online advertising have been suggested by the CMA and other regulators internationally.<sup>86,87</sup> These include technological measures, such as mandating data separation and third-party access to data,<sup>10,107,108</sup> and ensuring



competition concerns raised by alternatives to third-party cookies are addressed;<sup>98</sup> plus wider approaches to boosting competition between digital platforms more generally.<sup>86,87</sup>

## Data separation and data access

The CMA has recommended that the DMU be given powers to mandate data separation, which would prohibit companies from sharing certain types of data between the different platforms they own.<sup>10</sup>

Subject to data protection law requirements being met, companies that offer targeted advertising may use data collected about users on one platform to improve the targeting of ads to those users on their other platforms.<sup>109</sup> Data separation could prevent companies from collecting data from platforms in sectors where they have market power and applying it to other markets where it could suppress competition.<sup>10,110,111</sup> This may reduce the quality of platforms by making them less personalised, according to the Centre for European Reform thinktank.<sup>112</sup>

In 2019, the German competition regulator (Bundeskartellamt) prohibited Facebook from assigning data collected from Meta-owned services (such as Instagram and WhatsApp) and data from third-party cookies (collected from 'like' and 'share' buttons on other websites, Box 2) to a user's Facebook account without user consent.<sup>113</sup>

Compared to smaller rivals, Google and Meta have access to large amounts of data that can be used to provide ad performance metrics to advertisers.<sup>114</sup> The CMA has recommended that the DMU be given powers to require platforms to provide third parties access to certain types of data, in a way that complies with data protection regulations. For example, to allow independent analysis of the success of advertising campaigns.<sup>10</sup>

## Alternatives to third-party cookies

In 2022, Google committed to addressing the CMA's competition concerns with the development of application programming interfaces (APIs) that aim to preserve user privacy and allow webpages viewed using Chrome to function smoothly without third-party cookies.<sup>98</sup> In 2022, Google and the CMA agreed legally binding commitments to test and trial these APIs, primarily for effectiveness.<sup>98</sup> Examples of APIs being trialled on Chrome are:

- **Topics API** – will enable targeted advertising via mapping websites to topics of interest. Browsing history will be used to calculate the topics most likely to be of interest to a user and ads will be targeted accordingly. Chrome plans to allow users to remove topics from their browser.<sup>115</sup>
- **FLEDGE** – will allow DSPs to add an interest group, such as "sport", to a user's browser when they visit a website. When the user visits a website with advertising space to sell, the publisher's SSP can use FLEDGE to run auctions according to these interest groups.<sup>116</sup>

Other alternatives to third-party cookies include identifier-based approaches, such as Unified ID 2.0, RampID, and the Secure Web Addressability Network.<sup>117-120</sup> These approaches generally involve a user providing personal information (such as an email address) that is used to create an 'identifier', allowing data collected across different

platforms to be linked to the same ID and used for targeted advertising. Generally, a user will be able to set preferences for how their data will be used.<sup>121</sup>

## Wider approaches to increasing competition

Other approaches aim to increase competition between online platforms across digital markets, not just in online advertising.

The CMA has suggested that the DMU be granted new separation powers regarding the operation or ownership of different platforms owned by the same company,<sup>10,108,122</sup> and that Google be mandated to share its click and query data with competitors.<sup>10,108</sup> It has also recommended that the DMU have powers to implement interoperability requirements to overcome data access barriers (for example, by making it easier for users to transfer their data from one platform to another).<sup>10,107,123</sup>

In the EU, the Digital Markets Act (2022) introduced interoperability requirements, data access and separation approaches, and mandated the sharing of click and query data for designated “gatekeeper” platforms.<sup>108,124</sup> An academic survey of 11,000 consumers internationally concluded that some measures aimed at increasing competition (such as those that rely on users to transfer their data) may be hampered by a lack of digital literacy.<sup>125</sup>

A 2022 joint statement by Ofcom and the CMA recognised that the aims of enhancing competition and online safety interact.<sup>126</sup> Some companies have suggested that interoperability requirements intended to drive competition by making it easier for people to switch service may make it harder to fulfil online safety commitments.<sup>126</sup>

## Implications for privacy

Online advertising has attracted concerns from data protection regulators and others. The ICO’s concerns include the unlawful gathering and processing of personal data to target and profile individuals, and a lack of meaningful user choice and control.<sup>13</sup>

Specific measures to increase competition may also raise challenges for privacy and data protection regulation.<sup>127</sup>

The ICO have noted that identifier-based approaches generally involve processing personal information (like email addresses), and questioned whether requiring users to provide this is necessary, proportionate or fair.<sup>121</sup> The Electronic Frontier Foundation (EFF) has expressed concerns about some identifier-based approaches, which enable tracking across devices. This is in contrast to third-party cookies, which only enable tracking on a user’s browser on one device.<sup>128</sup> EFF has called for a ban on targeted advertising based on users’ online behaviour.<sup>129</sup> Software company Mozilla (which owns the Firefox web browser) has also raised concerns about some identifier-based approaches, noting a lack of technical controls to ensure that data safeguarding policies are followed.<sup>130</sup> Privacy International has raised concerns with measures such as the sharing of click and query data, if it makes users identifiable.<sup>131</sup>

In 2021, a joint statement by the ICO and CMA recognised that despite strong synergies between the aims of protecting data and enhancing competition, there may also be potential tensions if competition measures involve the sharing of personal data.<sup>127</sup> However, they concluded that both sets of aims can be achieved if measures to improve competition align with data protection law.<sup>127</sup>

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