Appendix C: market outcomes

Introduction

1. This appendix presents data on market outcomes, including revenues, shares of supply and prices. We first present data on the consumer side of the platforms, focusing particularly on general search and social media. We then set out data on search and display advertising. Finally, we present different estimates of the size of the open display sector and shares of supply in the adtech stack, as well as estimates of Google and Facebook's adtech revenues as a proportion of advertiser spend.

Consumer outcomes

2. In this section we present analysis of:

   - how consumers spend their time online, including the time spent on online entities and the 'reach' of the largest entities;
   - market outcomes for the general search sector, including: shares of supply; the number of consumers accessing different search engines; and consumer 'cross-visiting' behaviour across search engines;
   - market outcomes for the general voice search sector, including shares of supply by number of voice searches; and
   - market outcomes for the social media sector, including: the number of consumers accessing different social media platforms; shares of supply; and consumer 'cross-visiting' behaviour across social media platforms.

3. The data underlying this analysis was sourced from both third-party data providers and the parties (ie the social media platforms and general search engines), specifically:

   - **Comscore** data underlies the majority of the analysis described above. The data is sourced from Comscore's MMX Multi-Product (MP) interface.
   - **Statcounter** data is used as one measure of search engines' shares of supply and to inform our assessment of browsers' shares.
   - Data sourced from **the parties** is used to calculate shares of supply for search engines, voice search and social media platforms.

Sources of data

Comscore

4. Comscore delivers online audience measurement across different devices (desktop, tablet, smartphone) for different types of content (including page content, apps, video). Comscore is endorsed by UKOM, the body that sets and governs the UK standard for the online digital measurement industry.

Methodology

5. Comscore uses a 'hybrid approach' known as 'Unified Digital Measurement' (UDM), combining both 'panel' and 'census' data, where:

   - the panel data consists of recruited respondents who install metered software on their devices. Comscore's UK panel consists of roughly 130,000 users, including 66 thousand users for desktop and over 12 thousand users for mobile (tablet and smartphone).[1,2]

   - the census data is measured by Comscore 'tags' that media owners apply to their content.

6. These two sets of data are unified by Comscore and deduplicated,[3] to create an overall view of individual consumer behaviour online. For our analysis we used Comscore's MMX Multi-Platform data. The MMX Multi-Platform interface includes data from desktop, smartphone and tablet sources.

7. We have previously identified the following aspects of Comscore's methodology that may result in limitations of the output:[4]

   - Comscore's methodology is complex and involves a combination of modelling and direct measurement. Comscore's modelling relies on assumptions, based on insights from panel and enumeration data sources. This modelling is likely to be less robust than direct measurement.

   - Comscore's panel methodology could suffer from the same issues that affect online panels generally ie the results generated from Comscore's

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[1] As of October 2019.
[2] Comscore told us that it measures the activity of 'users' or 'visitors' of online entities rather than 'consumers'. However, we consider that Comscore's definition of a 'user' or 'visitor' is consistent with our use of the term 'consumer' within this publication. Throughout this publication we use the terms 'user' and 'consumer' interchangeably and generally refer to individuals as consumers, including in our descriptions of the outputs based on Comscore's data.
[3] To ensure that a single user, using more than one device, is not counted twice.
[4] See Annex E of the Fox/Sky Phase 2 Report.

panel may not be representative of the wider population as online panellists tend to be heavier internet or technology users.

- As media owners may choose which of their web pages/apps/videos to tag, not all web entities are measured using the census data. Additionally, because the tags are applied at the discretion of the publisher, making direct comparisons between sites is difficult.

8. Comscore has previously responded to us regarding the limitations we identified:

   - In relation to the issues we identified with Comscore's modelling and panel-based methodologies, Comscore explained that integrating both of these allows it to overcome the limitations suffered by each. For example:

     – Panel data: provides cookie-to-person conversion factors at the site level; allows for identifying and quantifying the extent of coverage gaps; and provides demographic information.

     – Census data: allows for increased granularity and stability, particularly for smaller media entities; facilitates quick coverage of new websites; delivers platform de-duplication insights; assures that all consumer activity within a media entity is credited; and provides an opportunity for calibration.

   - Comscore explained that it applies intensity weighting to its panel data to overcome the possibility that its panel is not representative of the population. This aligns the panel data with the actual intensity of use observed in the population as captured by the census data.

   - In relation to content tagging, Comscore explained that ideally all content would be tagged, but that there are a number of reasons why content may not be fully tagged or tagged at all. In these cases, Comscore works with existing information about entities' audiences to report on their complete audience:

     – Where content is not fully tagged, Comscore calculates the census tag coverage of the media entity. Comscore then uses its UDM methodology to account for the non-tagged portions of the entity, allowing it to report on the entity's entire audience. Comscore added that it works with UKOM and The Publishers' Audience Measurement Company (PAMCo) to help publishers tag their content completely.

     – Where entities are not tagged at all, they are measured through the panel data only, using weighted sample projections. For sites with

lower traffic, this can be less robust than UDM based on both panel and census data.

9. We note that the limitations that we have identified previously have been addressed to some extent by Comscore in its response. Moreover, notwithstanding any remaining concerns we have relating to these limitations, we believe Comscore to be the most comprehensive and accurate source of data on consumer behaviour online available to us. Comscore is widely used both within the industries we are examining and by other government bodies.

Level of measurement

10. Media owners have the option of segmenting their entities on Comscore to obtain audience metrics for a hierarchy of (sub)sections. Comscore offers six 'tiers' of measurement, which in descending order are: Property (P); Media Title (M); Channel (C); SubChannel (S); Group (G); and SubGroup (SG).

11. In relation to the general search sector, several search engines are operated by a company that owns many other non-search engine sites. The 'highest level' of reporting for these companies encompasses all these sites. For example, the 'highest level' of reporting for Google, is 'Google Sites' (P).[5] However, each search engine provider also offers a segmentation to the 'level' of their search engine, for example Google Search (C). Generally, this was the tier of segmentation used in our analysis as outlined in Table C.1.

Table C.1: Comscore entities analysed in the general search sector

Search Engine	*Publishers (P)/ Media title (M)/ Channel(C)/ Subchannel (S) Analysed*	*Notes*	*Level of unification*
Google	Google Search (C)	Consists of: Google Search (Mobile App); Google Web Search; Google Images Search; Google Video Search; Google News Search; Google Book Search; and Google Scholar Search.	Desktop Browser: Panel only; Smartphone iOS Browser: Panel only; Smartphone iOS Apps: Panel only; Smartphone Android Browser: Panel only; Smartphone Android Apps: Panel only; Tablet iOS Browser: Panel only; Tablet iOS Apps: Panel only; Tablet Android Browser: Not measured; Tablet Android Apps: Not measured.
Bing	Bing (M)	Consists of: Bing Web; Bing Images; Bing Videos; Bing Maps & Local; Bing Search (Mobile App); Bing News; Bing Travel; and Microsoft Translator.	Desktop Browser: Panel only; Smartphone iOS Browser: Panel only; Smartphone iOS Apps: Panel only; Smartphone Android Browser: Panel only; Smartphone Android Apps: Panel only; Tablet iOS Browser: Panel only; Tablet iOS Apps: Not measured Tablet Android Browser: Census only; Tablet Android Apps: Not measured.
Yahoo!	Verizon Media – Search Sites (M)	Consists of: Yahoo Search; Yahoo Answers; Yahoo	Desktop Browser: Panel only; Smartphone iOS Browser: Panel only; Smartphone iOS Apps: Not measured; Smartphone Android Browser: Panel only;

[5] This includes all Google owned websites including YouTube, Google Search, Gmail etc.

		Local Network; and AOL Search Network. AOL was incorporated into Verizon Search Sites in October 2017.	Smartphone Android Apps: Panel only; Tablet iOS Browser: Panel only; Tablet iOS Apps: Not measured; Tablet Android Browser: Census only; Tablet Android Apps: Not measured.
DuckDuckGo	DUCKDUCKGO.COM (P)	No further splits.	Desktop Browser: Panel only; Smartphone iOS Browser: Panel only; Smartphone iOS Apps: Not measured; Smartphone Android Browser: Panel only; Smartphone Android Apps: Not measured; Tablet iOS Browser: Panel only; Tablet iOS Apps: Not measured; Tablet Android Browser: Not measured; Tablet Android Apps: Not measured.
Ask*	ASK.COM Sites (M)	Consists of: Ask Reply Page; Ask Image Search; Ask Videos; Ask.co.uk.	Desktop Browser: Partially unified; Smartphone iOS Browser: Partially unified; Smartphone iOS Apps: Not unified; Smartphone Android Browser: Partially unified; Smartphone Android Apps: Not measured; Tablet iOS Browser: Census only; Tablet iOS Apps: Not measured; Tablet Android Browser: Census only; Tablet Android Apps: Not measured.
Yandex*	Yandex Web Search (C)	No further splits	Desktop Browser: Panel only; Smartphone iOS Browser: Not measured; Smartphone iOS Apps: Not measured; Smartphone Android Browser: Panel only; Smartphone Android Apps: Not measured; Tablet iOS Browser: Not measured; Tablet iOS Apps: Not measured; Tablet Android Browser: Not measured; Tablet Android Apps: Not measured.
HotBot*	HOTBOT.COM (M)	No further splits.	Desktop Browser: Not measured; Smartphone iOS Browser: Panel only; Smartphone iOS Apps: Not measured; Smartphone Android Browser: Not measured; Smartphone Android Apps: Not measured; Tablet iOS Browser: Not Measured; Tablet iOS Apps: Not Measured; Tablet Android Browser: Not Measured; Tablet Android Apps: Not Measured.
AOL*	AOL Search Network (M)	No meaningful further splits. AOL was incorporated into Verizon Search Sites in October 2017.	Desktop Browser: Fully unified; Smartphone iOS Browser: Partially unified; Smartphone iOS Apps: Not measured; Smartphone Android Browser: Partially unified; Smartphone Android Apps: Not measured; Tablet iOS Browser: Fully unified; Tablet iOS Apps: Not measured; Tablet Android Browser: Census only; Tablet Android Apps: Not measured.†

Source: Comscore MMX MP.
Notes: The entities included above are ordered in terms of user time spent as of June 2019.
* These search engines were aggregated into an 'other' category for the purposes of our analysis.
† As of September 2017, prior to being merged with Verizon Search Sites.

12. In relation to the social media sector, the 'highest level' of segmentation available was the most relevant for our analysis for every platform except Facebook. Facebook Inc. owns WhatsApp and Instagram, and the highest tier of segmentation, Facebook (P), includes these platforms in addition to the Facebook platform. We outline the entities analysed in the social media sector in Table C.2 below.

Table C.2: Comscore entities analysed in the social media sector

Social Media Platform	*Publishers (P)/ Media title (M)/ Channel(C)/ Subchannel (S) Analysed*	*Notes*	*Level of unification*
YouTube	YOUTUBE.COM (M)		Desktop Browser: Panel only; Smartphone iOS Browser: Panel only; Smartphone iOS Apps: Panel only; Smartphone Android Browser: Panel only; Smartphone Android Apps: Panel only; Tablet iOS Browser: Panel only; Tablet iOS Apps: Panel only; Tablet Android Browser: Not measured; Tablet Android Apps: Not measured.
Facebook	Facebook And Messenger (M)	Includes both the Facebook platform and Facebook's Messenger product.	Desktop Browser: Panel only; Smartphone iOS Browser: Panel only; Smartphone iOS Apps: Panel only; Smartphone Android Browser: Panel only; Smartphone Android Apps: Panel only; Tablet iOS Browser: Panel only; Tablet iOS Apps: Panel only; Tablet Android Browser: Not measured; Tablet Android Apps: Not measured.
Snapchat	Snapchat, Inc (P)		Desktop Browser: Panel only; Smartphone iOS Browser: Panel only; Smartphone iOS Apps: Panel only; Smartphone Android Browser: Panel only; Smartphone Android Apps: Panel only; Tablet iOS Browser: Panel only; Tablet iOS Apps: Panel only; Tablet Android Browser: Not measured; Tablet Android Apps: Not measured.
WhatsApp	WhatsApp (M)		Desktop Browser: Panel only; Smartphone iOS Browser: Panel only; Smartphone iOS Apps: Panel only; Smartphone Android Browser: Panel only; Smartphone Android Apps: Panel only; Tablet iOS Browser: Panel only; Tablet iOS Apps: Panel only; Tablet Android Browser: Not measured; Tablet Android Apps: Not measured.
Instagram	INSTAGRAM.COM (M)		Desktop Browser: Panel only; Smartphone iOS Browser: Panel only; Smartphone iOS Apps: Panel only; Smartphone Android Browser: Panel only; Smartphone Android Apps: Panel only; Tablet iOS Browser: Panel only; Tablet iOS Apps: Panel only; Tablet Android Browser: Not measured; Tablet Android Apps: Not measured.
Twitter	Twitter (P)		Desktop Browser: Panel only; Smartphone iOS Browser: Panel only; Smartphone iOS Apps: Panel only; Smartphone Android Browser: Panel only; Smartphone Android Apps: Panel only; Tablet iOS Browser: Panel only; Tablet iOS Apps: Panel only; Tablet Android Browser: Not measured; Tablet Android Apps: Not measured.
LinkedIn	Linkedin (P)		Desktop Browser: Fully unified; Smartphone iOS Browser: Partially unified; Smartphone iOS Apps: Panel only; Smartphone Android Browser: Partially unified; Smartphone Android Apps: Panel only; Tablet iOS Browser: Fully unified; Tablet iOS Apps: Panel only; Tablet Android Browser: Census only; Tablet Android Apps: Not measured.
TikTok	TIKTOK.COM (M)		Desktop Browser: Panel only; Smartphone iOS Browser: Panel only; Smartphone iOS Apps: Panel only; Smartphone Android Browser: Panel only; Smartphone Android Apps: Panel only; Tablet iOS Browser: Not measured; Tablet iOS Apps: Panel only; Tablet Android Browser: Not measured; Tablet Android Apps: Not measured.

Pinterest	Pinterest (P)	Prior to July 2017, PINTEREST.COM (P) was used.	Desktop Browser: Panel only; Smartphone iOS Browser: Panel only; Smartphone iOS Apps: Panel only; Smartphone Android Browser: Panel only; Smartphone Android Apps: Panel only; Tablet iOS Browser: Panel only; Tablet iOS Apps: Panel only; Tablet Android Browser: Not measured; Tablet Android Apps: Not measured.
Reddit	Reddit (P)		Desktop Browser: Partially unified; Smartphone iOS Browser: Fully unified; Smartphone iOS Apps: Panel only; Smartphone Android Browser: Fully unified; Smartphone Android Apps: Panel only; Tablet iOS Browser: Partially unified; Tablet iOS Apps: Panel only; Tablet Android Browser: Census only; Tablet Android Apps: Not measured.
Tumblr	Tumblr (M)	Prior to June 2016 TUMBLR.COM* (M) was used.	Desktop Browser: Fully unified; Smartphone iOS Browser: Partially unified; Smartphone iOS Apps: Panel only; Smartphone Android Browser: Partially unified; Smartphone Android Apps: Panel only; Tablet iOS Browser: Partially unified; Tablet iOS Apps: Panel only; Tablet Android Browser: Census only; Tablet Android Apps: Not measured.

Source: Comscore MMX MP.
Notes: The entities included above are ordered in terms of user time spent as of June 2019. Unification information as of June 2019.

Statcounter data

13. Statcounter is a web analytics service which uses tracking code to record page views to its 'member sites', numbering roughly 2 million websites globally. Using the data generated, Statcounter publishes its Global Stats. These include shares of supply for search engines and browsers.[6]

14. These shares are calculated on the basis of page 'referrals':

- the share for a given search engine represents the quantity of page referrals generated through that search engine, as a proportion of total page referrals generated through search engines. Statcounter generates shares for the top 17 search engines.

- the share for a given browser represents the quantity of page referrals generated through that browser as a proportion of total page referrals generated through browsers.[7]

15. We consider that possible limitations to Statcounter's methodology may include:

- the 'member sites' for which Statcounter records data may not be representative of the population. Statcounter does not reweight its data to correct for any potential issues relating to this.

[6] In addition to other data including OS Market Share, Screen Resolution Stats, Social Media Stats etc.
[7] See further Statcounter Global Stats, Search engine shares, accessed 01/11/2019.

- it is possible that some consumers' adblockers and browser preferences may prevent data on consumers' visits from being sent to Statcounter.

- the way in which a search engine sends referrals may also affect the data's accuracy, with some search engines sending referrals in such a way that they are not recorded by Statcounter.

16. Statcounter does not currently produce material assessing the extent of measurement error in its data. However, we note that its 'Global Stats' resource is widely used within the general search industry to assess shares. Moreover, we have examined Statcounter's shares in tandem with shares based on Comscore data. The results we found are broadly consistent.

Parties' data

General search

17. We received data submissions regarding the total number of searches across different device types per month for five general search engines. We have used these submissions to calculate shares of supply based on the number of searches made on search engines.

18. Each party's description of their data is listed below:

- **Google:** Google measured total searches as the total number of valid queries (excluding spam events).[8]

- **Bing:** Bing measured total searches as all searches relating to core traffic on "bing.co.uk" and "bing.com/cc=uk". Core traffic relates to all searches resulting in a Bing branded default results page.[9]

- **Yahoo!:** Bing, as the syndication partner to Yahoo!, measured total searches as all "user-typed" searches resulting in a Yahoo branded default results page.[10]

- **Ecosia:** Bing, as the syndication partner to Ecosia, measured total searches as all searches from Ecosia.[11]

- **DuckDuckGo:** DuckDuckGo provided searches as sourced from Yahoo Partner Insights (YPI).[12] This data represents the vast majority of all

[8] Google response to s174 of 03/03/2020.
[9] Microsoft response to s174 of 27/03/2020.
[10] Microsoft response to s174 of 01/04/2020.
[11] Microsoft response to s174 of 01/04/2020.
[12] DuckDuckGo response to s174 of 03/04/20.

traffic for DuckDuckGo with an additional very small percentage resulting from Yandex syndication. A remaining very small percentage of searches predominantly arrive from bots.[13]

Social media

19. Ten social media platforms submitted data regarding the time spent by their users on different device types per month. Most platforms utilised different methods to calculate the total time spent by users on their platform. We note this as a limitation of the data which may lead to the total time spent being under- or over-reported by the different platforms relative to each other.

20. The parties' descriptions of their methodologies used to calculate total time spent by users, in addition to our assessment of said methodology, are listed below:

- **YouTube:** YouTube provided time spent as video watch time. This data included time spent on devices, such as TVs, which are not available for other social media platforms.[14] We believe this method underestimates time spent on YouTube but note that YouTube has more avenues for users to spend time than other social media platforms.
- **Facebook:** [✂] We believe this is an accurate method of measuring user time on Facebook.
- **WhatsApp:** [✂]
- **Instagram***:* [✂]
- **Snapchat:** Snap provided the time spent per day, on average, by UK Daily Average Users [DAUs]. This was multiplied by the average number of DAUs per month to calculate the total time spent each month.[15] Average time spent was not weighted by the number of DAUs. We believe this method has the potential to either over- or under-estimate time spent on Snapchat.
- **Twitter:** [✂] We believe the time spent on Twitter will be overestimated.
- **LinkedIn:** LinkedIn calculates "dwell time" by counting the time spent on LinkedIn and setting caps on what time is considered.[16] For example, if a mobile user closes the app or is inactive for more than 30 seconds, the

[13] DDG response of 01/06/2020 as follow up to DDG data submission of 29/04/2020.
[14] Google response to s174 of 03/03/2020.
[15] Snap response to s174 of 10/03/20.
[16] LinkedIn response to s174 of 01/04/2020.

inactive time is removed from total time spent. We believe this is an accurate method of measuring user time on LinkedIn.

- **TikTok:** TikTok did not provide data on desktop usage as it noted that while TikTok has a website with some content and information, it does not serve advertising on the website and is a mobile app first.[17] We believe the time spent on TikTok will be undercounted.

- **Pinterest:** Pinterest catalogues time spent for the duration of time that the Pinterest website or app is in focus.[18] We believe this is an accurate method of measuring user time on Pinterest.

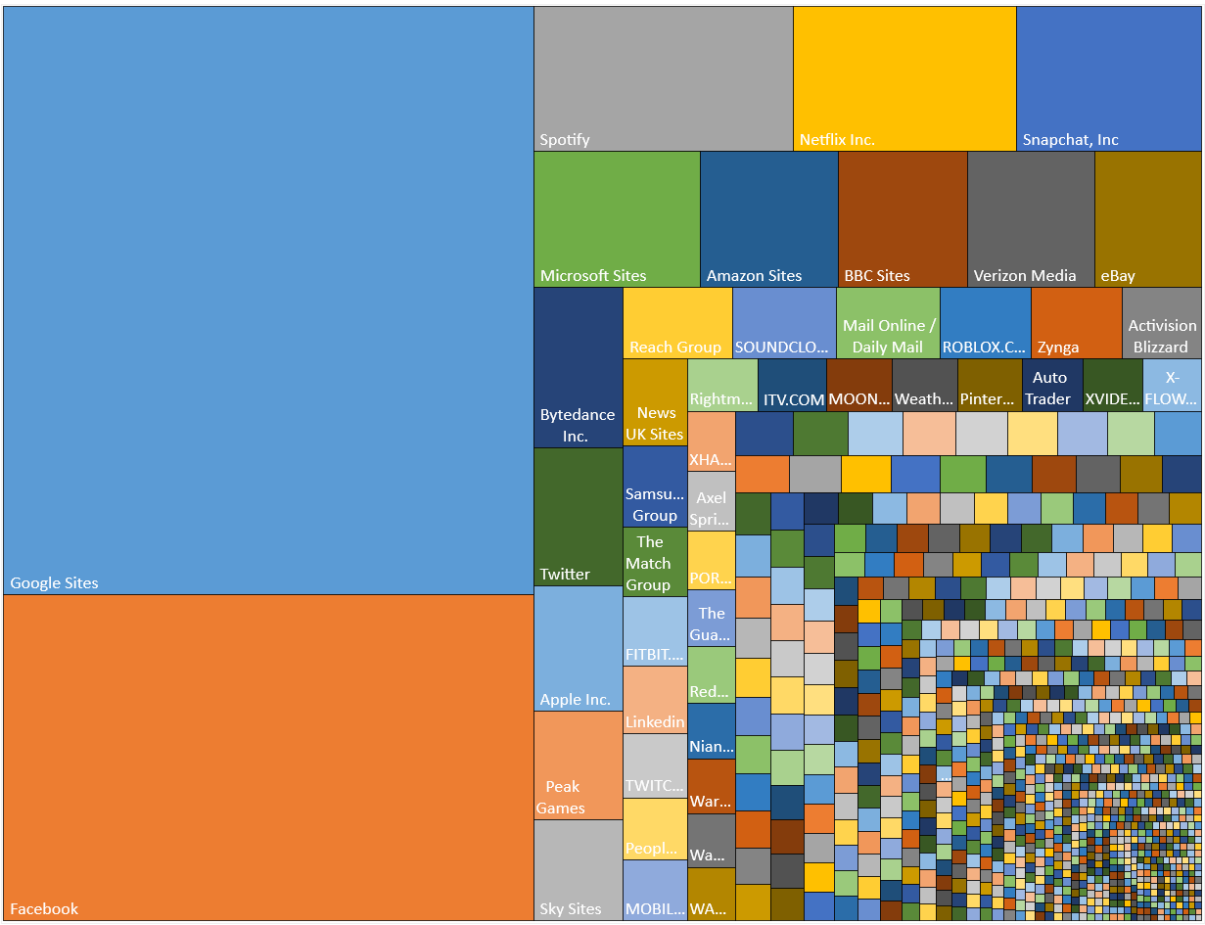
- **Tumblr:** Tumblr catalogues time spent based on session time for users.[19] Tumblr provided time spent on the mobile app due to potential inaccuracies when measuring time on desktop or mobile browsers.[20] We believe the time spent on Tumblr will be undercounted.

Consumer behaviour online

21. We used Comscore data to assess how consumers spend their time online.[21] Consumers spend 37% of their total time online on Google sites (including YouTube) and Facebook sites (including Instagram and WhatsApp) combined (24% on Google sites and 13% on Facebook sites).[22] In comparison, Spotify – a music streaming service – is the next biggest source of user time spent online, accounting for just 2% of time spent online.

[17] TikTok, Response to s174 of 10/03/20.
[18] Pinterest, Response of 10/03/20 to follow-up questions from meeting on 03/03/20.
[19] Tumblr, Response to s174 of 17/04/20.
[20] Tumblr, Response to s174 of 17/04/20.
[21] For the analysis presented below, we used the 'highest level' of reporting available through Comscore rather than the entities specified in Tables C.1 and C.2 eg Google Sites (P) rather than Google Search (C). This was to prevent double counting.
[22] Where Google Sites includes all properties owned by Google eg YouTube, Google Search, Gmail etc.

Figure C.1: Time spent by UK consumers on the top 1000 online properties

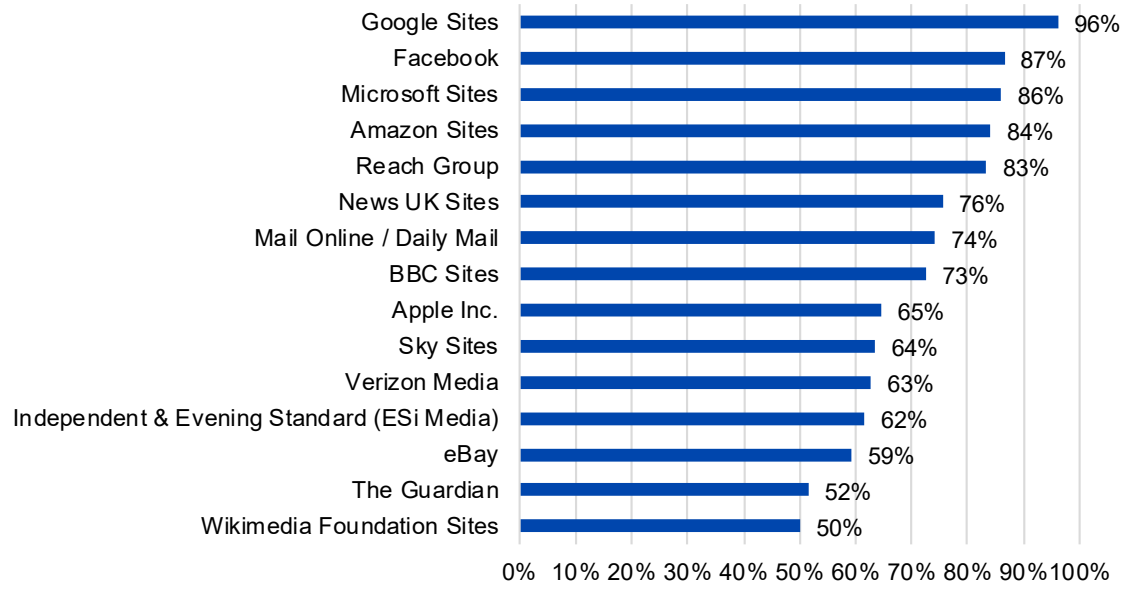


Source: Comscore MMX Multi-Platform, Total Digital Population, Desktop aged 6+, Mobile aged 13+, February 2020, UK.
Notes: Top 1000 properties account for 83% of total user time spent online.
* Where 'Google Sites' includes all Google owned properties eg YouTube and Google Search.
†Where 'Facebook' includes Facebook, Instagram and WhatsApp.

22. The top 1,000 properties in terms of time spent are presented at Figure C.1. UK consumers spend 83% of their total time online on these top 1,000 properties, although 50% of total time spent comes from the top 10 properties. Figure C.1 demonstrates that users spend the majority of their time online on a limited set of websites, with the remainder being spent on a 'long tail' of websites.

23. We also assessed the reach of the top websites in the UK, which is presented in Figure C.2. Reach is defined here as the percentage of the UK's online population that access an online entity within a calendar month. Google sites have the greatest reach at 96%, followed by Facebook with 87%.

Figure C.2: Top 15 properties by reach



Source: Comscore MMX Multi-Platform, Total Digital Population, Desktop aged 6+, Mobile aged 13+, February 2020, UK

Search: shares of supply

24. Given the 'zero-price' nature of the services offered to consumers by general search providers, we are unable to calculate shares of supply on the basis of providers' direct revenues from users.

25. We consider that the number of individual search queries entered into each search engine is the most appropriate metric for calculating shares amongst general search engines. This is because we believe the number of searches reflects the intensity with which users engage with a search engine and accounts for a search engine's capacity to display answers to some queries directly on the results page.[23] We have been able to gather this data directly from market participants.

26. In addition, we have considered the following alternative measures using data provided by Comscore and Statcounter:

- number of unique visitors;
- shares calculated on the basis of page views;
- shares calculated on the basis of consumer time spent on search engines; and

[23] Google, for example, displays a weekly forecast on the results page when a user searches "weather".

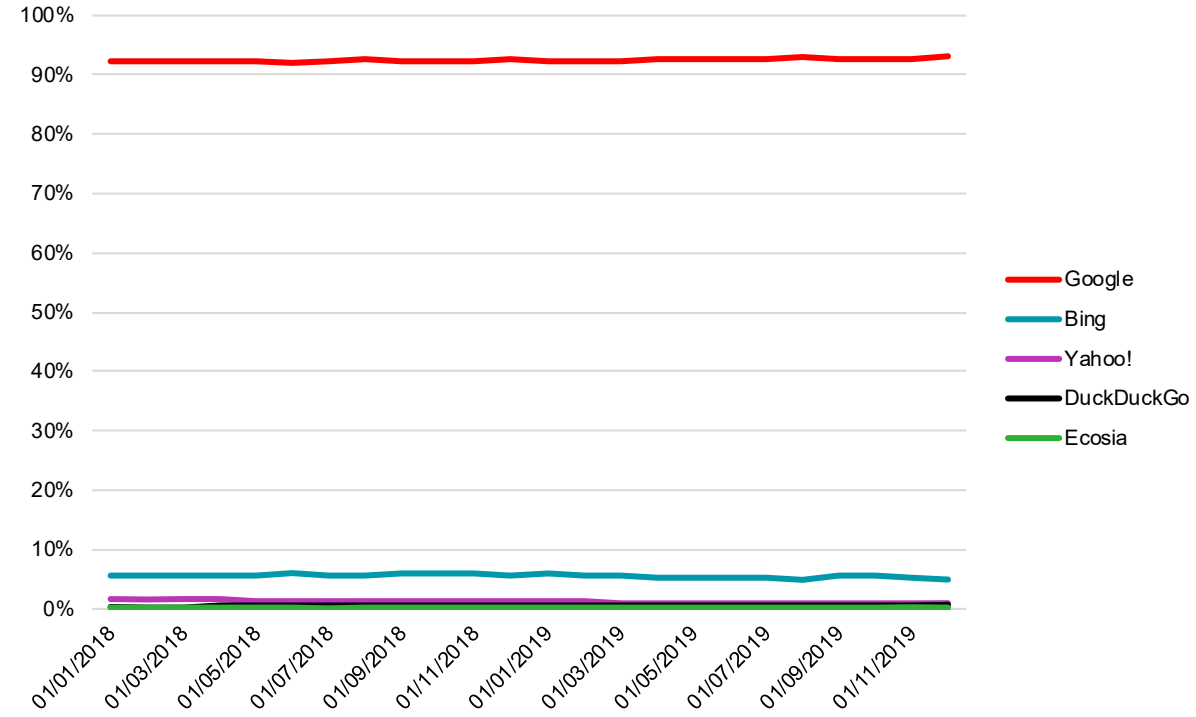
- shares based on the number of page referrals made by a search engine.

27. We have found that regardless of the measure used to assess search engines' shares of supply, Google mostly maintains a high share of approximately 90% in the market. The following section presents our findings.

Search: shares by number of searches made by consumers

28. We present shares of supply based upon the number of total searches from Bing, DuckDuckGo, Ecosia, Google and Yahoo! at Figure C.3 below. Google has maintained a majority share of [90-100]% over the course of 2018-2019. Bing follows this with a share of 5% by the end 2019. All other search engines displayed shares of 1% or below.

Figure C.3: Shares of supply by total number of searches from January 2018 to December 2019



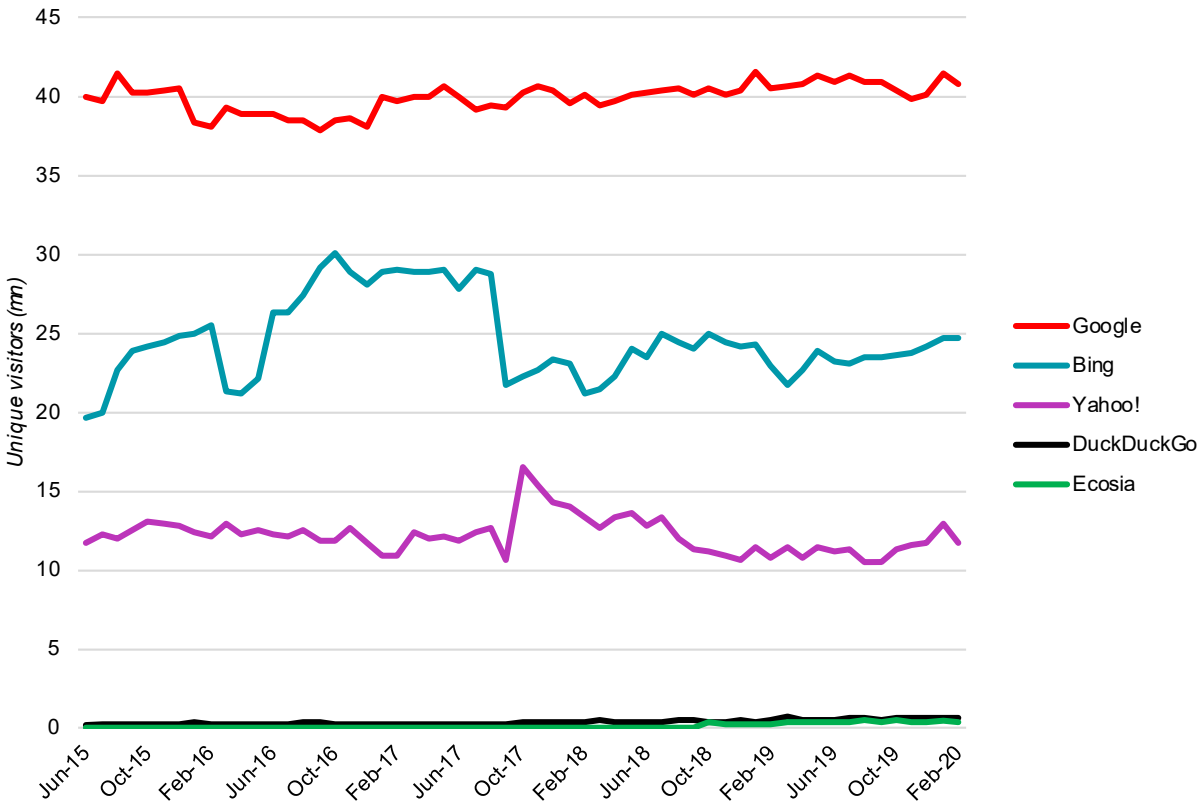
Source: CMA Analysis of search engines' data

Search: unique visitors

29. This data was sourced from Comscore and represents the number of unique visitors to a search engine with a calendar month.

30. Figure C.4 number of unique visitors to each of Bing, DuckDuckGo, Ecosia, Google and Yahoo!. Google has by far the greatest number of unique visitors at nearly 41 million consumers, followed by Bing with roughly 25 million consumers. We note that the monthly unique visitors measure does not capture the intensity with which consumers use different search engines.

Figure C.4: Monthly unique visitors from June 2015 to February 2020



Source: Comscore MMX Multi-Platform, Total Digital Population, Desktop aged 6+, Mobile aged 13+, June 2015 – February 2020, UK

Search: shares by 'total views'

31. 'Total views' represent the total number of page views and desktop video views on a website within a calendar month. We note that:

    - this measure does not account for page views made on apps; and
    - features sometimes offered by search engines mean that results from visual, video, shopping or other results pages are incorporated into the main results.

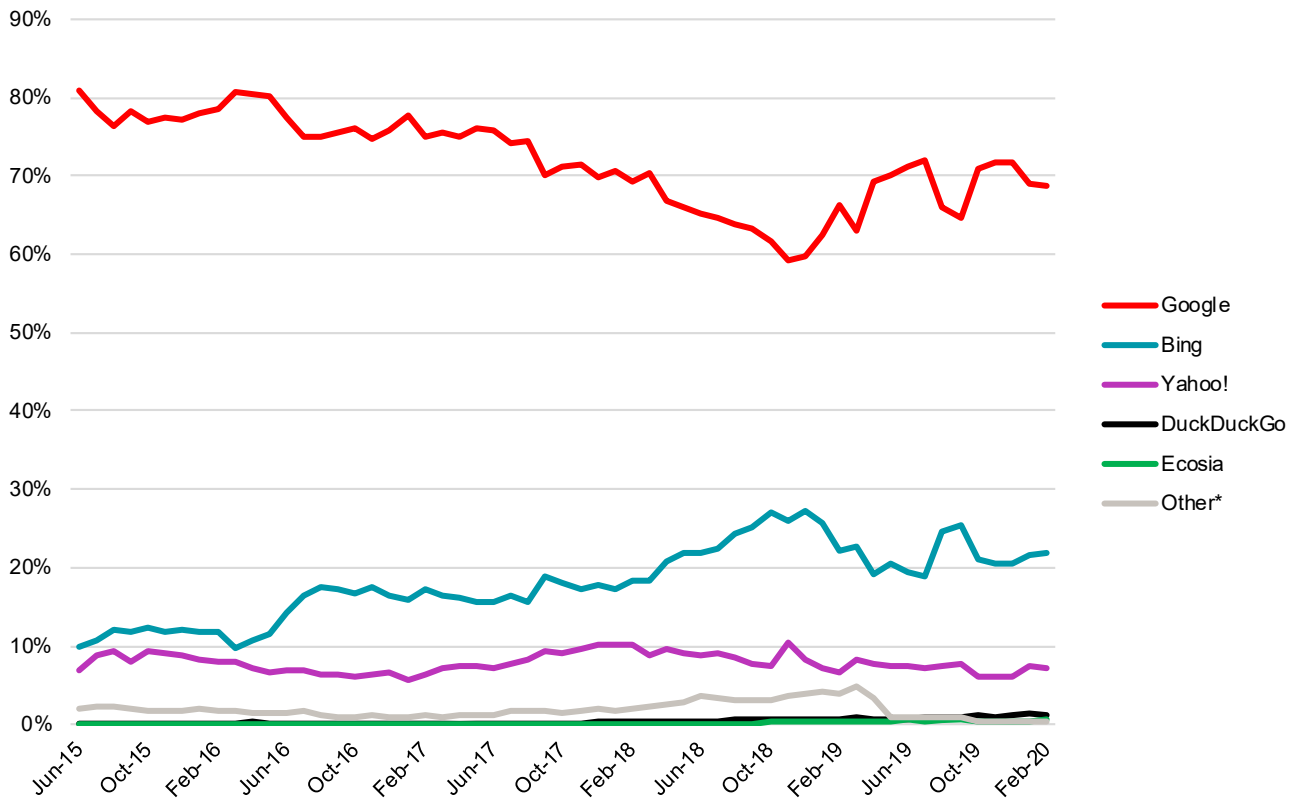
32. As a result, it will understate consumers' use of a given search engine, limiting the accuracy of shares calculated based on this measure.

33. Figure C.5 shows search engines' shares of supply based on the number of page views made by consumers.

34. On the basis of this metric, Google has a lower share compared to the value calculated using any of the other measures we present here, ranging between 59% to 81%. Bing and Yahoo! both have a higher share in comparison to that calculated on the basis of any other metric, ranging from 10% to 27% and from 6% to 10% respectively.

35. We note that the shares for Google, Bing and Yahoo presented in Figure C.5 are inconsistent with the shares presented in all of the other measures for shares of supply. Given this and the statements above, we believe that shares on the basis of total page views do not provide a reliable indication of the parties' shares.

Figure C.5: Shares of supply by page views from June 2015 to February 2020



Source: Comscore MMX Multi-Platform, Total Digital Population, Desktop aged 6+, Mobile aged 13+, June 2015 – February 2020, UK
*'Other' consists of Ask, and, prior to October 2017; AOL; Hotbot.com; and Yandex

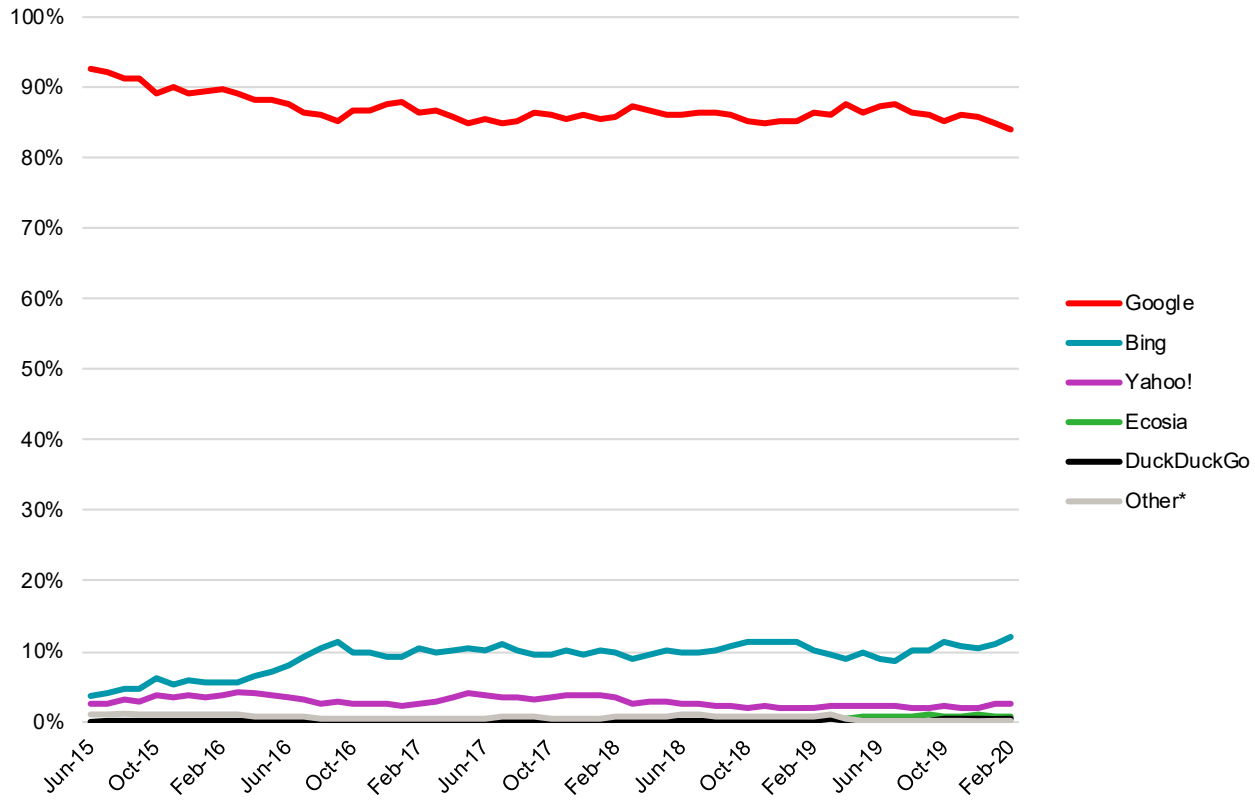
Search: shares by consumer time spent

36. The underlying data for these shares was sourced from Comscore. We consider that shares calculated on the basis of consumer time spent on search engines may also provide a less reliable assessment of search engines' shares. This is because time spent by consumers on search engines' websites may not consistently capture the intensity with which they use these services.

37. Figure C.6 presents shares of supply based on consumer time spent on the largest general search engines in the UK over the last five years.

38. As shown by Figure C.6, Google has had a very high and stable share for the duration of the period for which we have data. Google's share ranges between 84% and 93%. Bing is the next largest search engine with a share ranging between 4% and 12% from July 2015 to February 2020.

Figure C.6: Shares of supply by consumer time spent from June 2015 to February 2020



Source: Comscore MMX Multi-Platform, Total Digital Population, Desktop aged 6+, Mobile aged 13+, June 2015 – February 2020, UK
*'Other' consists of Ask, and, prior to October 2017; AOL; Hotbot.com; and Yandex

Search: shares by page referrals

39. In addition to calculating shares of supply using Comscore data, we assessed search engines' shares using Statcounter's Global Stats.[24] Statcounter generates shares on the basis of search engines' 'page referrals'. In this context, a page referral is when a user accesses a website after clicking a hyperlink on a search engine page.

40. We consider that shares calculated on the basis of page referrals are an informative measure of general search engines' shares. We believe that page

[24] See above for a discussion of Statcounter's methodology.

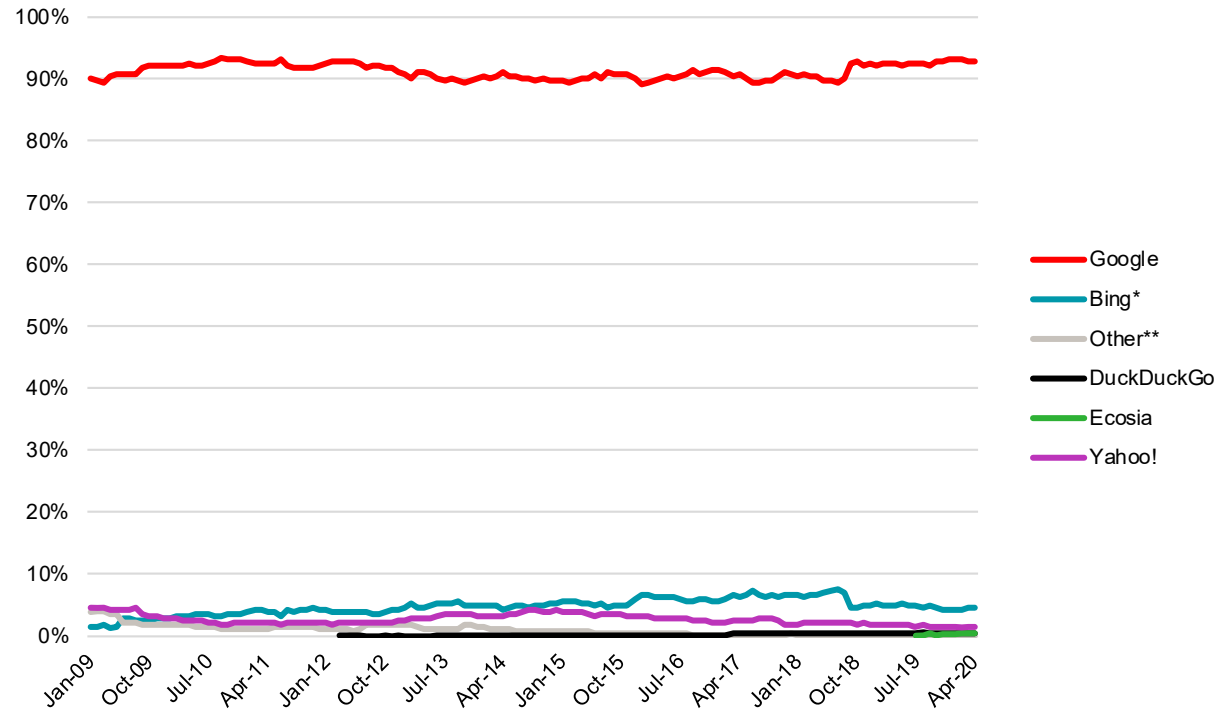
referrals represent users' intensity of use of different search engines and are not subject to the same limitations as page views or consumer time spent.

41. However, we note that these may not be as accurate as shares based on the number of searches made on search engines. This is because page referrals will not account for search engine usage where the answer desired by the consumer is displayed directly on the results page, eg through 'instant answers'.

42. Shares by page referrals are presented in C.7. Consistent with the shares calculated using Comscore's time spent data, Google holds a very high and stable share of supply throughout the entire ten-year period with its share ranging between 89% and 93%. Bing's share ranges between 1% and 8% throughout this period.

43. We note that Statcounter calculates shares for the top 17 search engines in terms of number of page referrals. On the basis of Statcounter's metrics, Ecosia became a top 17 search engine in July 2019 and as a result was not included in Statcounter data prior to this date.

Figure C.7: Shares of supply by page referrals from January 2009 to April 2020

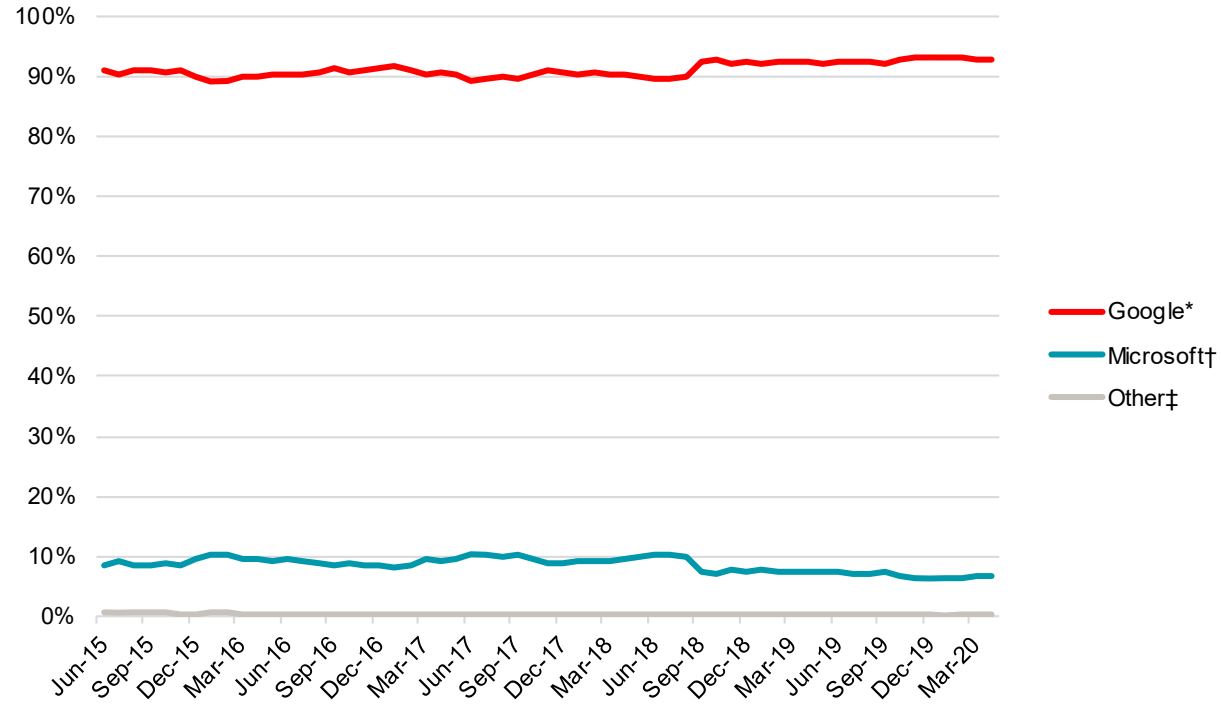


Source: Statcounter Global Stats.
Notes: UK data.
* Bing's share represents that of Bing and MSN Search. MSN Search was rebranded as Bing in 1998.
** 'Other' consists of: AlotSearch; AOL; AskJeeves; AVGSearch; Babylon; Baidu; Conduit; NortonSafeSearch; Snapdo; Webcrawler; WindowsLive; Yandex; and 'other'.

44. As discussed in Chapter 3, only Google and Bing maintain an at-scale English-language index of webpages, with other search engines buying

organic links and adverts from Google or Bing through syndication agreements. In Figure C.8 we present syndication partners' shares of supply by combining the shares of search engines that syndicate through each of Google and Microsoft respectively.

Figure C.8: Shares of supply among web index providers by page referrals from June 2015 to April 2020



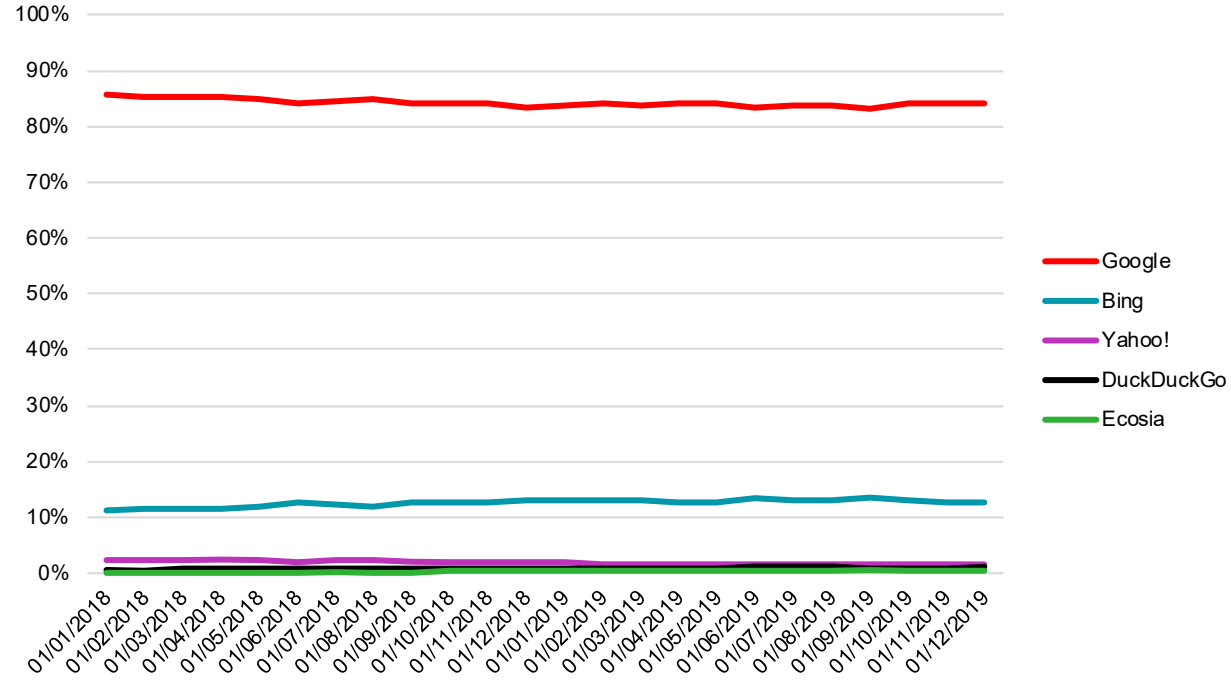
Source: Statcounter Global Stats.
Notes: UK data for June 2015 – April 2020.
* Google's share consists of Google Search.
† Microsoft's share consists of Bing; DuckDuckGo; and Yahoo!.
‡ 'Other' consists of: AlotSearch; AOL; AskJeeves AVGSearch; Babylon; Baidu; Conduit; NortonSafeSearch; Snapdo; Webcrawler; WindowsLive; Yandex; and 'other'.

Search: shares by device type

45. To further analyse general search platforms' position, we calculated the platforms' shares on desktop devices (including laptops) and mobile devices (including tablets), based upon the number of searches made through search engines. These are presented at Figures C.9 and C.10 below.

46. Figure C.9 represents general search engines' shares on desktop devices based upon the number of searches made through Bing, DuckDuckGo, Ecosia, Google and Yahoo!. Google has maintained a share of 83-86% throughout 2018 to 2019. Bing, as the next biggest general search provider, maintained a share of 11-13%. It appears that both providers' shares have remained relatively stable from 2018-2019.

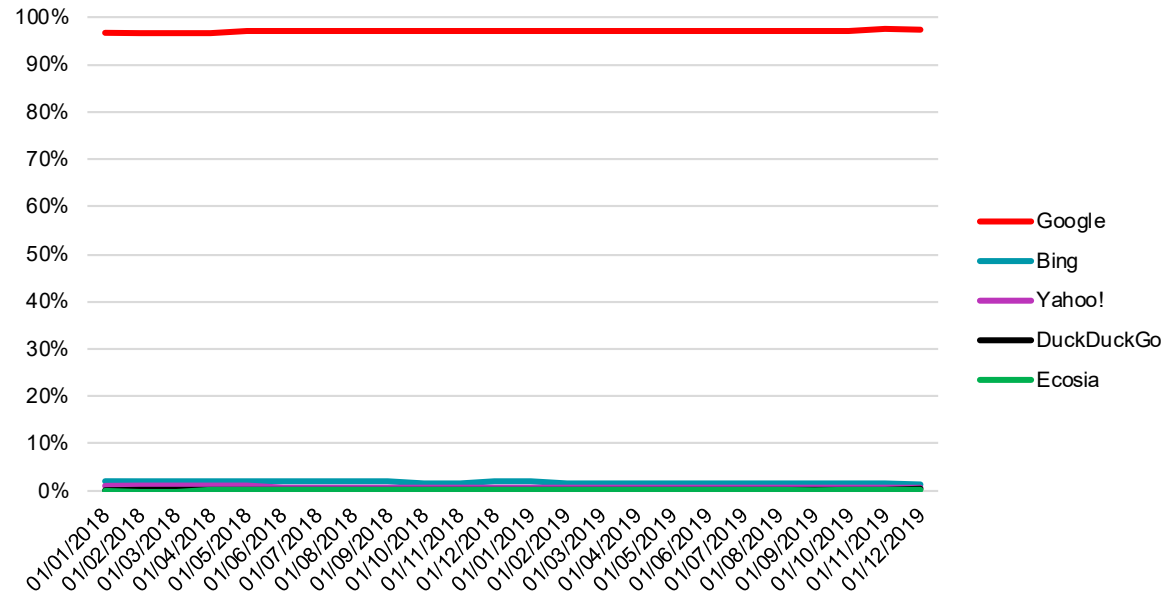
Figure C.9: Shares of supply by number of searches made on desktop devices from January 2018 to December 2019



Source: CMA Analysis of search engines' data
Notes: Where 'desktop' devices includes laptops.

47. Figure C.10 presents search engines' shares on mobile devices based on the number of mobile searches made through Bing, DuckDuckGo, Ecosia, Google & Yahoo!. Google accounts for almost all mobile searches with a share of 97% throughout 2018 and 2019. All other general search engines have a share of 1% or below.

Figure C.10: Shares of supply by number of searches made on mobile devices from January 2018 to December 2019



Source: CMA Analysis of search engines' data
Notes: Tablets are included in mobile devices.

48. When considering the two figures above it is important to note that mobiles serve as the primary channel for general search for many consumers, accounting for 68% of all general searches in December 2019. This is an increase from 60% in January 2018, which also indicates that the role of mobile in general search is likely to grow even further. In contrast, desktop searches are becoming less prevalent with the total number of desktop searches decreasing over time.

Search: consumer cross-visiting

49. We used Comscore's 'cross-visiting' data to assess the extent to which users access more than one search engine.

50. Table C.3 summarises consumers' cross visiting behaviour for the five largest search engines in the UK. The percentages in each cell represent the proportion of consumers of the 'row search engine' that also accessed the 'column search engine' in the same month. Table C.3 demonstrates a moderate to high prevalence of user cross-visiting, particularly between the consumers of each of the smaller search engines and Google. Specifically: 67% of Bing users access Google; 68% of Yahoo! users accessed Google; 74% of DuckDuckGo users accessed Google; and 69% of Ecosia users accessed Google. This indicates that a relatively low proportion of consumers who use Google feel the need to cross-visit compared consumers who use other search engines.

Table C.3: Consumer cross-visiting behaviour amongst general search engines

	Google	*Bing*	*Yahoo!*	*DuckDuckGo*	*Ecosia*
Google	N/A	41%	20%	1%	1%
Bing	67%	N/A	29%	1%	1%
Yahoo!	68%	62%	N/A	1%	1%
DuckDuckGo	74%	51%	18%	N/A	1%
Ecosia	69%	57%	19%	2%	N/A

Source: Comscore MMX Multi-Platform, Total Digital Population, Desktop aged 6+, Mobile aged 13+, February 2020, UK.

51. Therefore, this evidence suggests that many consumers access more than one search engine per month. However, Comscore's cross-visiting data does not account for intensity of use. If a consumer accesses one search engine's home page but performs all of their monthly searches via another search engine, that consumer will still be recorded as having 'cross-visited' between the two search engines. Therefore the proportion of users that 'cross-visit' as recorded in Table C.3 above is greater than the proportion of users that regularly access, or intend to access, multiple search engines.

52. When it comes to intensity of use, as noted in Chapter 3, the evidence we have seen generally suggests that many consumers mostly use one general search engine.

General voice search

53. In addition to the data provided for general search, we additionally asked Google, Amazon and Bing for data on voice search queries.

54. Google provided data on 'Assistant' voice queries that return search results.[25] Google noted this data includes queries such as asking Google Assistant to play songs. In December 2019 Google processed [250-300] million voice queries in total.[26] Home devices were the most popular method for accessing 'Assistant' voice queries and accounted for [70-80%] of all 'Assistant' voice queries in December 2019. Overall, the total number of voice queries Google received in December was equivalent to [0-5%] of all text-based queries Google received the same month.[27] However, Assistant voice queries grew [140-150%] between January 2018 and December 2019. This growth was primarily driven by an increase in 'Assistant' voice queries on home devices.

55. Bing provided data on all user voice searches that resulted in a Bing branded default results page.[28] In December 2019 Bing processed [one to five million]

[25] Google, response of 19/05/2020 to follow-up questions from s174 of 03/03/2020.
[26] Google response to s174 of 03/03/2020.
[27] Google response to s174.
[28] Microsoft response to s174 of 27/03/2020.

user voice searches in total. Desktop devices were the most popular method for accessing user voice searches and accounted for [70-80%] of all user voice queries. The total number of voice queries Bing received in December 2019 is equivalent to [0-5%] off all text-based queries Bing received in the same month. Furthermore, unlike Google, the number of user voice searches decreased by [160-170%] over the course of 2018-2019.

56. Amazon provided the number of 'Search-type' intent utterances.[29] Amazon described 'search-type' intent as when Alexa infers that the speaker is looking for something, which might capture requests to look for products or some types of general information requests.[30,31] Amazon explained that 'search-type' utterances comprised on average [less than 1%] of total UK utterances in the period December 2018 to December 2019.

57. In December 2019 Amazon processed [one to five million] 'search-type' intent utterances.[32] Home devices were the predominant channel for users and represented [90-100]%' of all 'search-type' utterances. Finally, the total number of 'search-type' intent utterances increased by [20-30]% from December 2018 to December 2019.

58. It is difficult to ascertain whether or not general voice search is becoming more prevalent. While Google data showed a significant increase in the number of 'Assistant' voice searches, there was only a moderate increase in 'search-type' intent utterances for Amazon and the number of user voice searches on Bing decreased. As the data provided to us by each provider is not comparable, it is therefore difficult to determine the underlying factors for each provider's trend.

59. Overall, two trends emerged from our analysis of the data. The first is that general voice search is very small when compared to traditional text-based general search. Second, general voice search appears to be heavily reliant on home devices. Most voice-searches are conducted on home devices and Google and Amazon, both popular providers of home-based devices, exhibited a significantly higher number of voice-type searches than Bing for whom most voice searches came through desktop devices.

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[29] Amazon response to s174 of 09/04/2020
[30] Amazon, response to s174 of 09/04/2020.
[31] Amazon noted that Alexa responds to general information queries but does not offer general search functionality to customers. Amazon response to s174 of 09/04/2020.
[32] Amazon response to s174 of 09/04/2020.

Social media

60. In this section we present market outcomes for a sample of 11 of the largest social media platforms in the UK. The platforms included here are Facebook (including Messenger), Instagram, LinkedIn, Pinterest, Reddit, Snapchat, TikTok, Tumblr, Twitter, WhatsApp, and YouTube.

61. As with general search providers, the 'zero-price' nature of the services offered to consumers by social media platforms means we cannot calculate shares of supply on the basis of providers' direct revenues from users. We consider that the time spent on a platform is the most appropriate metric for calculating shares amongst social media platforms as we believe this metric most accurately represents consumers' engagement with a platform's service.

62. We additionally consider the number of unique visitors (or 'active users'), and 'reach' of platforms. Due to network effects inherent to social media platforms we believe this also provides an indication of a platform's competitive strength.

63. We also have access to data from Comscore on the number of page views consumers make on social media platforms. However, we consider that this data is less suitable for calculating shares amongst social media platforms. The structure of some social media platforms, particularly those that are predominantly accessed via mobile devices, means that consumers do not need to view several pages to engage with the service. As a result, page views are unlikely to give an accurate indication of consumers' engagement with social media platforms or of the platforms' competitive positions.

Social media: total time spent by consumers on social media platforms

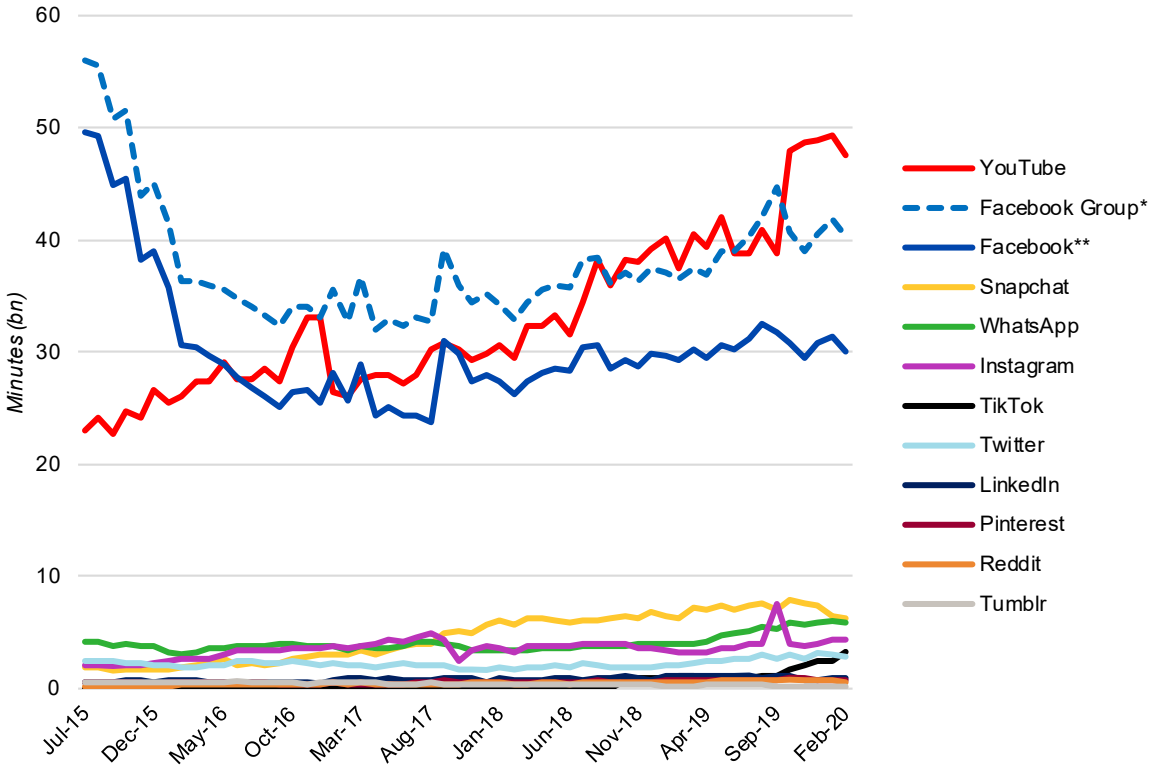
64. We present total time spent on social media platforms using data sourced from both Comscore's MMX Multi-Platform product and the parties' submissions. Due to inconsistencies in how different platforms measured time spent by their users we believe that the values sourced from Comscore's data more accurately represent the market. We note that for parties whose methodology we deemed to be accurate, the user time spent related in their submissions was generally consistent with the values we sourced from Comscore.

Total time spent based on Comscore data

65. Figure C.11 shows the total time spent by consumers on social media platforms based on Comscore data. Consumers currently spend the greatest quantity of time on YouTube – 48 billion minutes in February 2020. Consumer

spend the next greatest quantity of time on Facebook with 30 billion minutes. The two next largest platforms, WhatsApp and Snapchat, are significantly smaller with approximately 6 billion minutes each.

Figure C.11: Total time spent on social media platforms from July 2015 to February 2020 (including YouTube)



Source: Comscore MMX Multi-Platform, Total Digital Population, Desktop aged 13+, July 2015 to February 2020
* Including Facebook, Messenger, Instagram & WhatsApp
** Including Messenger, Instagram and WhatsApp
Notes: In November 2018 and September 2019, Comscore altered its methodology which contributes to the discontinuities in the data around this date. The spike in Instagram's share in September 2019 is due to a processing issue which over-estimated Instagram's share of time spent online

Total time spent based on social media platforms' data

66. Figure C.12 represents the shares of supply by consumer time spent based upon social media platforms' data submissions. Consumers spend by far the greatest amount of time on YouTube with [90-100] billion minutes recorded in December 2019. Facebook (including Messenger) follows YouTube with users spending [over 50 billion minutes online in total].

Figure C.12: Total time spent on social media platforms from July 2018 to December 2019 (including YouTube)

[✂]

67. As previously noted, there was no consistent methodology to measuring time spent amongst the different platforms and as such, it is possible that platform's user time spent may be relatively under- or over-estimated when

compared to one-another. For example, time spent on YouTube only included video watch time and as such is likely to undercount the total time spent on YouTube.

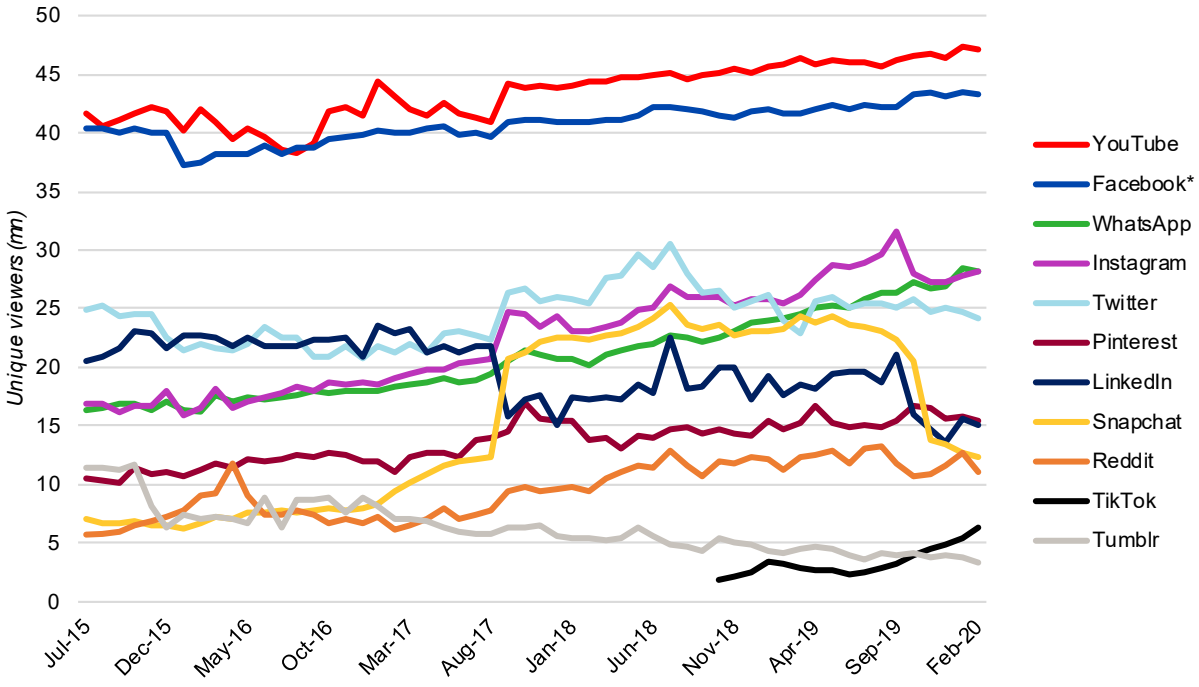
68. We therefore believe that Figure C.11 provides a more accurate comparison of user time spent across platforms.

Social media: unique visitors

69. This data was sourced from Comscore's MMX MP product. We consider that a social media platform's active users, or 'unique visitors', give a meaningful indication of its competitive strength because of the role of network effects in the social media sector. A larger consumer audience will likely make the platform more valuable to both consumers and advertisers.

70. Figure C.13 below presents monthly unique visitors for each of the 11 social media platforms from July 2015 to February 2020. As demonstrated by this figure, Facebook and YouTube have the largest number of active users and both appear to be growing.

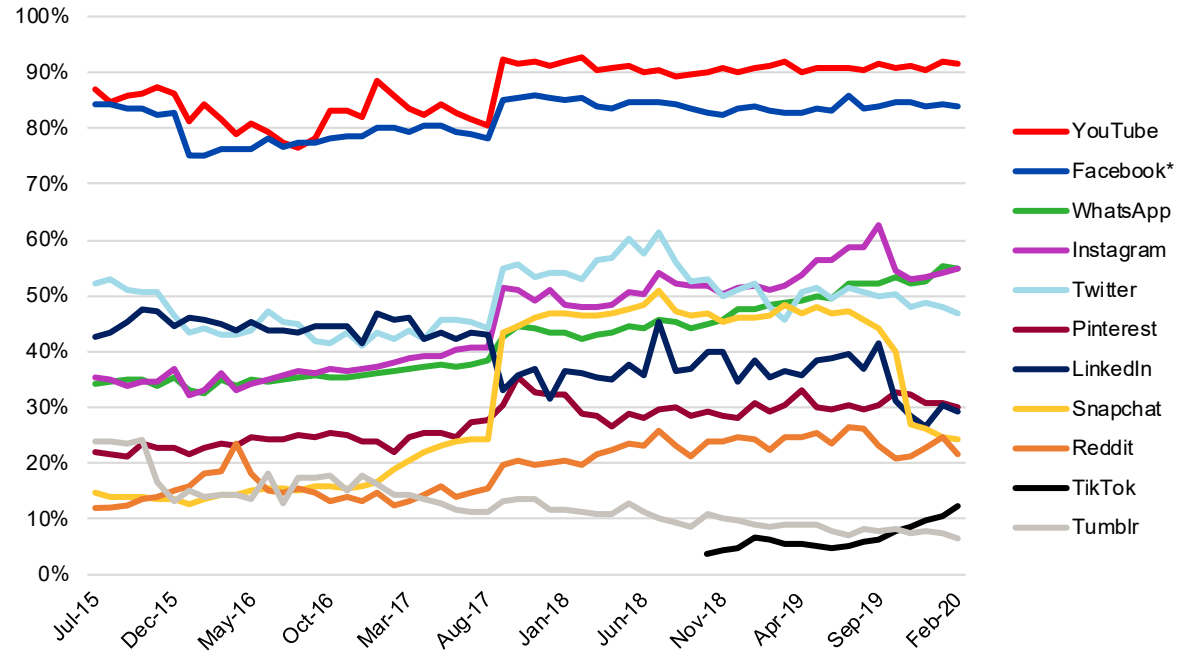
Figure C.12: Monthly active users on social media platforms from July 2015 to February 2020 (including YouTube)



Source: Comscore MMX Multi-Platform, Total Digital Population, Desktop aged 6+, Mobile aged 13+, July 2015 – February 2020, UK
Notes: In November 2018 and September 2019, Comscore altered its methodology which contributes to the discontinuities in the data around these dates. * Including Messenger

71. Figure C.14 below shows the 'reach' of each of the 11 social media platforms. Reach is defined here as the percentage of the UK's online population that accesses an online entity. Facebook and YouTube have the greatest reach of these platforms. In February 2020, Facebook had a reach of 84% and YouTube had a reach of 92%. Both Instagram and WhatsApp had a reach of 54%.

Figure C.13: Social media platforms' reach from July 2015 to February 2020 (including YouTube)



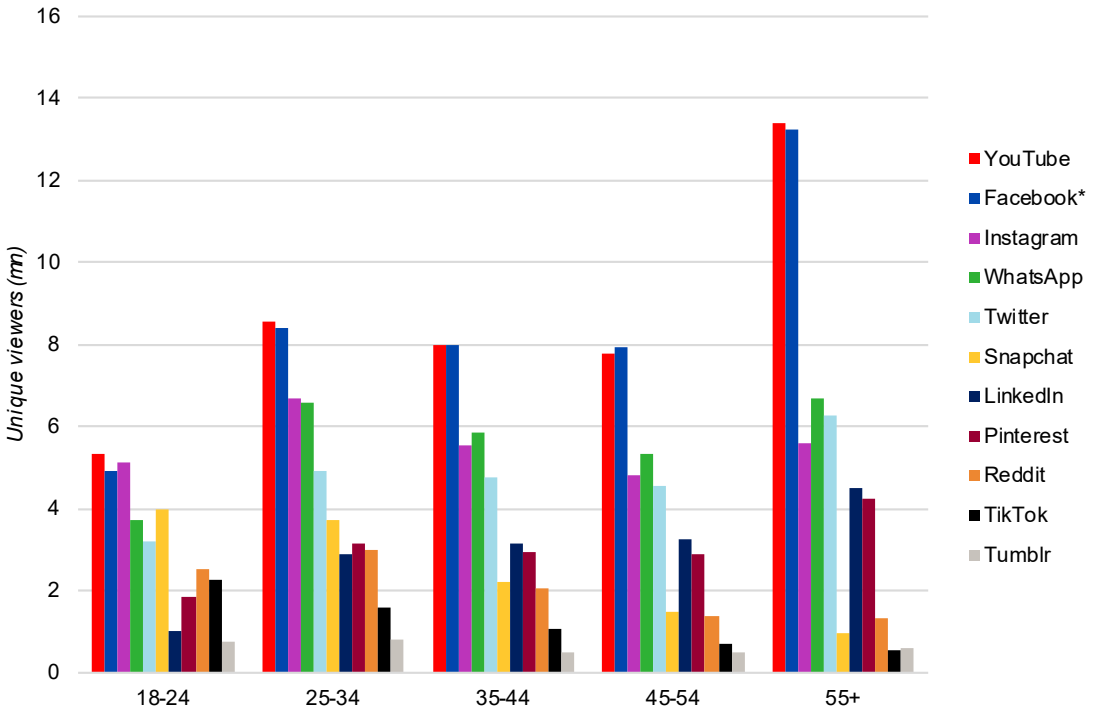
Source: Comscore MMX Multi-Platform, Total Digital Population, Desktop aged 6+, Mobile aged 13+, July 2015 – February 2020, UK
* Including Messenger.
Notes: In November 2018 and September 2019, Comscore altered its methodology which contributes to the discontinuities in the data around these dates.

72. As discussed in Chapter 3, social media platforms may be differentiated on the basis of their user base, with certain platforms being particularly popular amongst consumers within different age segments. To assess this, we examined platforms' shares of user time spent, monthly active users and reach amongst five consumer age segments, presented at Figure C.15 to Figure C.16 below.

73. Figure C.15 depicts each platform's monthly active users by age segment. Facebook and YouTube have the greatest number of monthly active users amongst all age groups. The 18-24 age group is the exception to this, where Instagram is slightly above Facebook but below YouTube. Facebook and

YouTube also have a significantly higher number of monthly active users aged 55 and above.

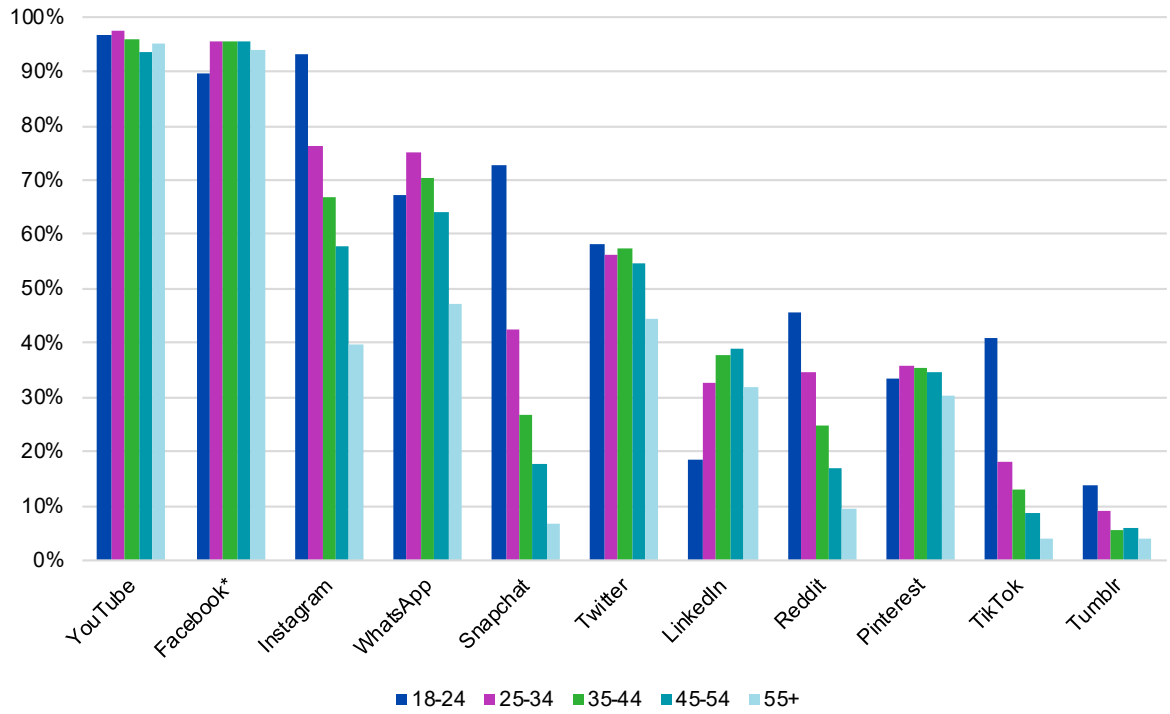
Figure C.14: Monthly active users by age segment (including YouTube)



Source: Comscore MMX Multi-platformP, Total Digital Population, Desktop aged 6+, Mobile aged 13+, February 2020, UK
* Including Messenger.

74. Figure C.16 demonstrates each platform's reach by age segment. Facebook and YouTube have the greatest reach amongst all age segments. With the exception of LinkedIn, the age segment with the lowest reach for every social media platform is 55+. We note that some platforms have particularly strong reach amongst the youngest age segments eg Instagram, Snapchat, Reddit, Tumblr and TikTok.

Figure C.15: Reach by age segment (including YouTube)



Source: Comscore MMX Multi-Platform, Total Digital Population, Desktop aged 6+, Mobile aged 13+, February 2020, UK
* Including Messenger.

Social media: shares of supply

75. As discussed in Chapter 3, there is a significant degree of differentiation between social media platforms. Of the platforms that we assessed, there are particularly important differences between YouTube, which most consumers use for video streaming, and platforms such as those of Facebook, which focus more on consumer needs related to social networking. Therefore, in order to obtain a more meaningful indicator of Facebook's market power, we have not included YouTube when calculating shares of supply in social media based on time spent. Therefore in Figure C.17, and henceforth unless otherwise stated, any statistics that we present for 'social media' do not include YouTube.

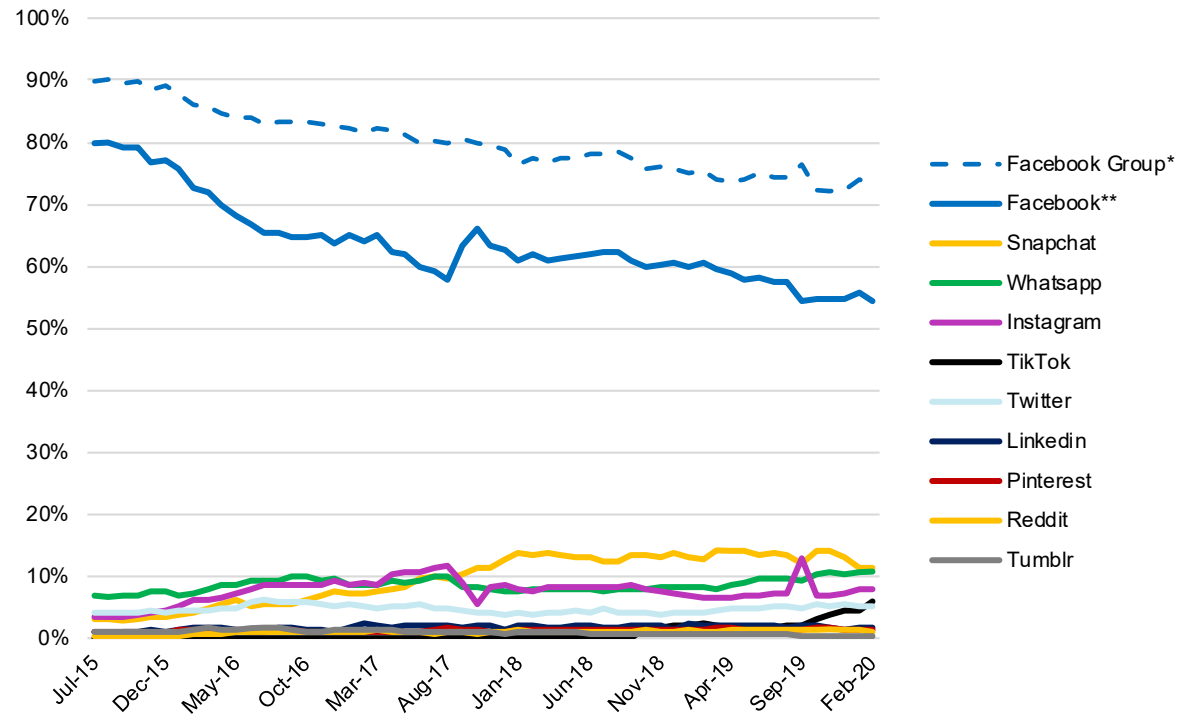
Shares of supply based on Comscore data

76. On this basis, Figure C.17 shows that Facebook has the highest share of user time spent at 54% in February 2020, down from its 80% share in July 2015. However, we note that Facebook owned and operated platforms accounted for 73% of user time spent on social media in February 2020.[33] From 2018 to 2019 Snapchat achieved the second highest share of social media platforms

[33] These include Facebook (including Messenger), WhatsApp and Instagram.

although in February 2020 it shared this position with WhatsApp at 11% share each.

Figure C.16: Shares of supply by user time spent on social media from July 2015 to February 2020



Source: Comscore MMX Multi-Platform, Total Digital Population, Desktop aged 6+, Mobile aged 13+, July 2015 – February 2020, UK.
* Including Facebook, Messenger, Instagram and WhatsApp
** Including Messenger
Notes: In November 2018 and September 2019, Comscore altered its methodology which contributes to the discontinuities in the data around these dates.

Shares of supply based on social media platforms' data

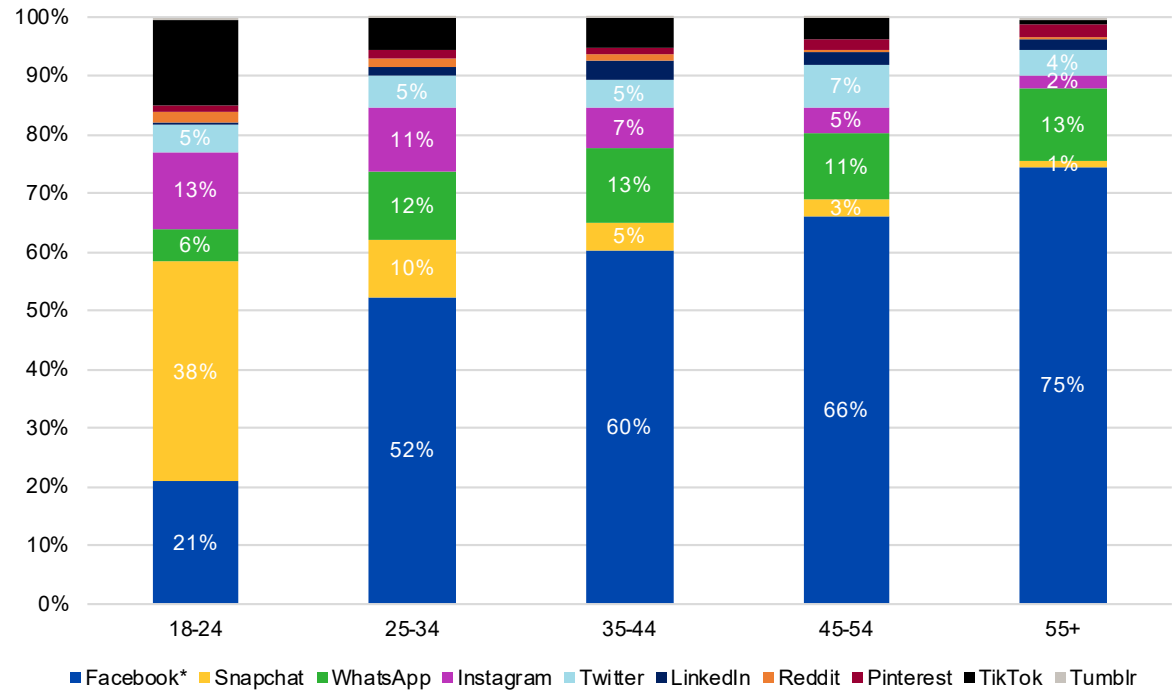
77. Figure C.18 depicts shares of supply by user time for spent based on social media platforms' data. In December 2019 Facebook possessed the largest share of supply by user time, accounting for [30-40]% of user time.

Figure C.17: Shares of supply amongst social media by consumer time spent from May 2018 to December 2019

[✂]

78. We also calculated social media shares by age segment, as shown in Figure C.19. The varying distributions amongst the different age segments on different platforms are again clearly evident, particularly in relation to Facebook and Snapchat.

Figure C.18: Shares of supply by age segment by user time spent



Source: Comscore MMX Multi-Platform, Total Digital Population, Desktop aged 6+, Mobile aged 13+, February 2020, UK.
*Including Messenger.

Social media: consumer cross-visiting

79. We used Comscore's 'cross-visiting' data to assess the extent to which consumers access multiple social media platforms.[34] Table C.4 summarises the results for a sample of ten of the largest platforms. The percentages in each cell represent the proportion of users of the 'row platform' that also accessed the 'column platform' in the same month.

Table C.4: Consumer cross-visiting behaviour amongst social media platforms

	*Facebook**	*Instagram*	*WhatsApp*	*Twitter*	*Snapchat*	*LinkedIn*	*Pinterest*	*Reddit*	*Tumblr*	*TikTok*
*Facebook**	N/A	63%	63%	53%	26%	33%	33%	22%	6%	13%
Instagram	97%	N/A	70%	58%	36%	26%	37%	23%	8%	18%
WhatsApp	97%	70%	N/A	57%	34%	27%	35%	20%	7%	16%
Twitter	94%	68%	66%	N/A	33%	33%	39%	28%	11%	17%
Snapchat	90%	81%	78%	63%	N/A	26%	40%	28%	10%	33%
LinkedIn	94%	49%	51%	53%	21%	N/A	33%	22%	8%	9%
Pinterest	94%	67%	64%	62%	32%	32%	N/A	26%	13%	18%
Reddit	85%	58%	50%	60%	31%	30%	37%	N/A	14%	16%
Tumblr	81%	71%	56%	79%	38%	35%	61%	49%	N/A	23%
TikTok	86%	79%	73%	64%	65%	22%	45%	29%	12%	N/A

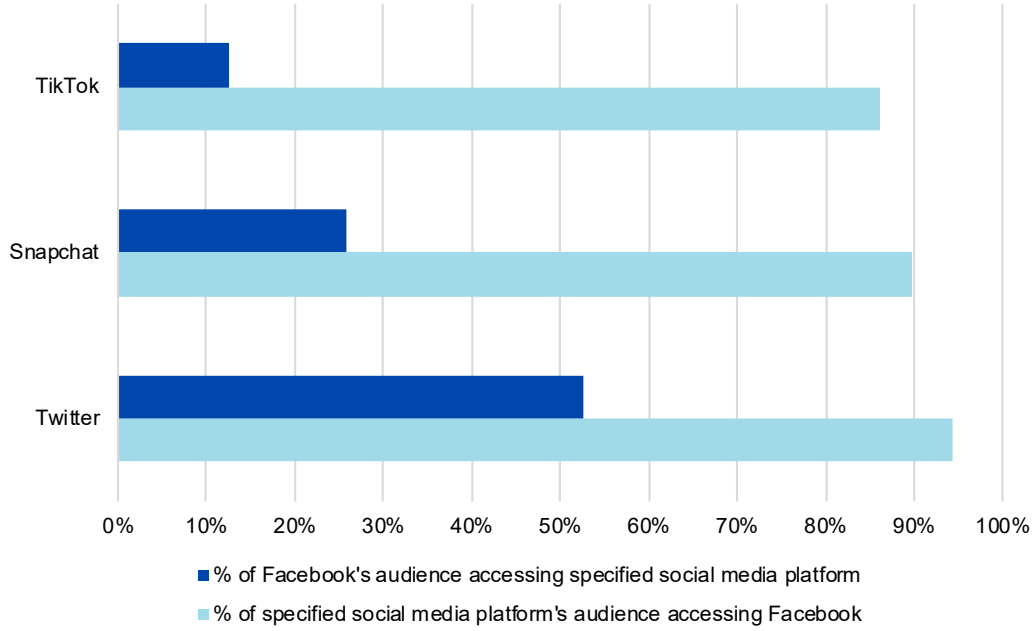
Source: Comscore MMX MP, Total Digital Population, Desktop aged 6+, Mobile aged 13+, February 2020, UK
* Including Messenger

[34] This analysis informed our assessment of user multi-homing in the social media sector. See further Chapter 3.

80. As demonstrated by Table C.4, we observe high rates of consumer cross-visiting across all ten of the platforms considered. Additionally, the overwhelming majority of platforms' users cross-visit with Facebook. In contrast, substantively lower proportions of Facebook's audience cross-visit with each of the remaining platforms.

81. This is illustrated by Figure C.20, which examines cross-visiting behaviour amongst the Facebook platform and three of the largest platforms outside of the Facebook Group (TikTok, Snapchat and Twitter).

Figure C.19: Consumer cross-visiting behaviour amongst Facebook, Instagram and Snapchat



Source: Comscore MMX Multi-Platform, Total Digital Population, Desktop aged 6+, Mobile aged 13+, February 2020, UK
*Including Messenger.

82. As explained previously, Comscore's cross-visiting data does not account for intensity of use. We are also unable to assess the extent to which individual consumers cross-visit across more than two platforms, eg the proportion of consumers that accessed three or four platforms within the month.

Advertising outcomes

83. In this section we present our analysis of advertising market outcomes. We begin with search advertising; then we proceed with display advertising, and we conclude with a more detailed analysis of the open display channel.

Search advertising

84. In this section we present our analysis on the size of the UK search advertising sector, the composition of revenue generated by Bing and its syndication partners and monetisation trends. In what follows we first

introduce the sources of data we have used to produce our estimates; then we discuss each outcome in turn.

Sources of data

85. Our primary source of data consists of the datasets we received from Google and Microsoft in response to our information requests, along with the accompanying explanatory notes and the responses to our related clarification questions.

86. Google provided us with:

- Annual data from 2010 to 2019 on its total revenue from search advertising, number of searches, number of searches with ads, number of ads shown and number of ad clicks;
- Monthly data from January 2017 to December 2019 on its revenue from search advertising, number of searches, number of searches with ads, number of ads shown and number of ad clicks broken down by device type;
- Average user click-through-rates (CTRs) on searches with at least one ad by the ad positional order in the search results page and the number of ads shown in the results page, at the aggregate level and broken down by device type for 2019; and
- Encoded queries, number of ads, number of ad clicks, revenue, CPC, price-bid ratio, user device type and user browser at the search event level for all searches conducted on its search engine over the course of one week in the UK.

87. Microsoft provided us with:

- Annual data on Bing's and Bing's syndication and sub-syndication partners' combined total revenue from search advertising in the UK from 2010 to 2018;
- Annual data from 2015 to 2019 on Bing's total revenue from search advertising, number of searches (with and without ads), number of ads shown and number of ad clicks;
- Monthly data from January 2017 to December 2019 on its revenue from search advertising, number of searches (with and without ads), number of ads shown and number of ad clicks broken down by device type;

- Monthly data from July 2016 to June 2019 on Bing's and Bing's syndication and sub-syndication partners' revenue generated from search advertising, split by Bing's service (eg Bing Search, Bing Shopping and Bing Maps) and syndication partner (eg Verizon Media, Ecosia and AOL);

- Average user click-through-rates (CTRs) on searches with at least one ad by the ad positional order in the search results page and the number of ads shown in the results page, at the aggregate level and broken down by device type for 2019; and

- Encoded query, number of ads, number of ad clicks, revenue, CPC, price-bid ratio, user device type and user browser at the search event level for all searches conducted on its search engine over the course of one week in the UK.

88. Throughout this section, we refer to the sum of revenue generated by Bing own branded consumer products and by Bing's syndication and sub-syndication partners' consumer products as 'Bing-generated revenue'. We refer to revenue generated through Bing's own branded products only as 'Bing's revenue'.

89. We have identified the following limitations in the data submitted by Google and Microsoft that we use to produce our estimates:

- Our discussions with Google suggest that the revenue generated by its syndication partners is negligible compared to Google's total revenue.

- In the annual data and the monthly data on Bing-generated revenue and related metrics, Microsoft attributed data to the UK on the basis of users' location (eg where Microsoft believes that advertisement was clicked on by a user located in the UK). In the annual and monthly data on Bing's own branded products revenue and related metrics, in the data on CTRs and in the search event-level dataset Microsoft attributed data to the UK based on UK URL domains or UK extensions of its main domain. While this poses potential issues in terms of the comparability of the datasets, as users might access different domains or domain extensions from that of the geography in which they are located, our discussions with Microsoft reassured us that this is not likely to materially impact our results. Google provided data attributed to the UK on the basis of users' location.

- Bing-generated revenue includes revenue generated by Bing's syndication and sub-syndication partners only for those periods when

the agreement with Bing was in place. This implies that fluctuations in Bing-generated revenue could potentially be attributed to or offset by new syndication agreements put in place or old syndication agreements being terminated.

- Microsoft did not provide data on revenue generated by syndication and sub-syndication partners for the period comprised between July and December 2019.

- Data on CTRs for both Google and Bing accounts for text ads only, while the other data accounts for all ads displayed (eg both viewed and 'unviewed' Google and Bing Shopping ads).

The size of the UK search advertising sector

Methodology

90. From our discussions with industry parties we understand that the UK general search advertising sector comprises two main groups of suppliers: Google; and Bing and its syndication and sub-syndication partners.[35]

91. To compute the overall size of the UK search advertising sector, we have summed Google's and Bing's search advertising revenue. Due to the structure of the data available to us and the limitations highlighted in the previous subsection, we have proceeded separately for the period between 2010 and 2018, and for 2019:

    - From 2010 to 2018: we have summed Google's annual revenue and Bing-generated revenue as reported in the annual data;

    - 2019: we have summed Google's revenue and Bing's revenue from the annual data with our estimate for Bing's syndication and sub-syndication partners' revenue in 2019.[36]

92. Both Google and Microsoft provided some of their data in U.S. dollars (US$). When revenue is expressed in US$, we have converted revenue from US$ to

[35] Providers of search services that focus on languages other than English have been excluded from this analysis. Search providers whose focus is on vertical search have been excluded from this analysis.
[36] In order to estimate Bing's syndication and sub-syndication partners' revenue in 2019, we have rescaled their revenue as reported in the monthly data from January to June. We have used a scale factor computed from the (simple) average of the proportion of their revenue generated from January to June over the revenue they generated in the entire year in 2017 and 2018. As this proportion stays roughly constant over the two years considered, and given the small scale of Bing's syndication and sub-syndication partners' revenue, we believe that the level of uncertainty introduced by this estimate is likely to be negligible for our overall estimates for the size of the UK search advertising sector.

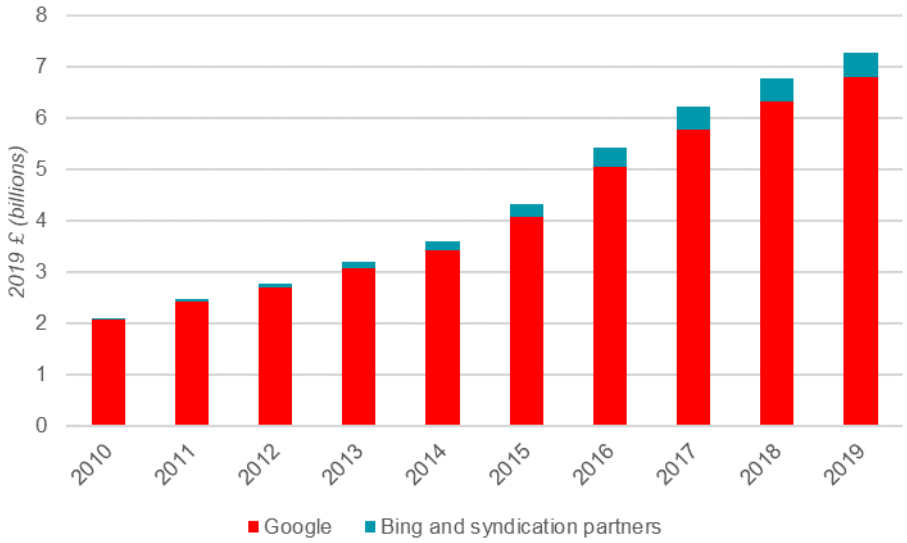
pound sterling (GBP) using the Bank of England reported US$ into GBP annual average spot exchange rate (XUAAUSS) for the annual data and the Bank of England reported US$ into GBP monthly average spot exchange rate (XUMAUSS) for the monthly data.

93. We have converted monetary figures from nominal to real to observe their evolution over time net of fluctuations due to changes in the UK economy general price levels. We have used 2019 as a base period for the annual data and December 2019 for the monthly data.[37]

Outcomes

94. Figure C.21 shows our estimates for the size of the UK search advertising sector by year from 2010 to 2019 in real 2019 GBP.

Figure C.21: Estimated UK search advertising revenues by year (2010-2019)



Source: CMA analysis of platforms' data.

95. As shown in Figure C.21, the UK search advertising sector has been growing rapidly, with total revenue increasing from around £2.1 billion in 2010 to £7.3 billion in 2019. This implies an average real compound annual growth rate of around 15%.[38] Both Google and Bing contributed positively to this growth:

[37] We have used the Office for National Statistics All Items CPI Index 00 (D7BT/MM23) as a source of general price levels in the UK economy.
[38] Our estimates are broadly comparable to those of the Internet Advertising Bureau (IAB), which estimated UK search advertising revenue to be worth £8 billion in 2019. The difference in estimates will be down to methodologies adopted, with ours based on data of actual revenue from industry participants. For more information on the IAB estimates see: IAB / PwC Digital Adspend 2019.

- Google's revenue from search advertising has increased from around £2.1 billion in 2010 to £6.8 billion in 2019, reflecting a compound annual growth rate of around 14%.[39]

- Bing-generated revenue has increased from around £[20-25] million in 2010 to £[450-500] million in 2019. However, care is needed when evaluating Bing-generated revenue growth path, as this might be partially driven by the implementation of new syndication agreements and/or the end of syndication agreements previously in place.[40]

96. These estimates are not directly comparable with the estimates we showed in our interim report, as we have used slightly different methodologies.[41]

97. Google has been by far the largest player in all the years considered. In 2019 Google generated more than 90% of the UK search advertising revenues (as computed using the methodology described above), more than an order of magnitude greater than its next closest rivals, Bing and its syndication and sub-syndication partners.

Composition of Bing-generated revenue

98. In this subsection we examine how Bing-generated revenue splits into revenue generated by Bing's own branded products and its main syndication partners.

- *Methodology*

99. We have used the monthly data on Bing's syndication and sub-syndication partners revenue to compute the relative shares of revenue generated by Bing's own branded search products and its main syndication partners.

100. As Microsoft did not provide us with data on syndication partner revenues for the second half of 2019, we have used data from the first half of 2019 to extrapolate estimates for 2019.[42]

[39] We note these estimates are based on internal figures provided by Google that had not been subject to audit.
[40] Given the relatively small size of Bing, this effect is not likely to materially impact the overall search advertising growth trend.
[41] In our interim report, we had used data on Google's search advertising revenue attributed to the UK on the basis of advertiser location. In this report it is attributed on the basis of user location.
[42] We show estimates computed on the first half of 2019 only. We do not expect these to be severely biased, as we do not identify substantial differences between the first and the second half of 2018.

101. In addition to the general limitations already presented, the monthly data Microsoft submitted also presents some limitations specific to the outcomes we estimate in this subsection:

- Revenue from the sale of search advertising on third-party properties is not included.
- Sub-syndication partners' revenues are included in their respective direct Bing syndication partner's revenue (eg Yahoo!'s and DuckDuckGo's revenues are included in Verizon Media's revenue).
- Microsoft did not separately identify revenue generated from vertical search products for all of Bing's syndication partners. Hence, for consistency we have included revenues generated from vertical search products for each party. However, we note that these represent a negligible share of revenue in all the instances for which it has been possible to compute them. Therefore, we do not expect this to materially impact our estimates.

- *Outcomes*

102. Figure 22 presents our results on the composition of Bing-generated revenue in 2019.

Figure C.22: Composition of Bing-generated revenue (2019)

[✂]

Source: CMA analysis of platforms' data.

103. As shown in Figure C.22, [✂]. This also applies to the previous year. [✂]. The other syndication partners generated only a minor share of Bing-generated search advertising revenue.

Google search trends

104. In this section we examine the evolution of Google's advertising revenues over a ten-year period and the main drivers behind these trends. We focus on revenue per search to control for search volumes.

105. Revenue per search is made up of the:

- proportion of searches that show an ad;
- number of ads shown on searches with an ad;
- click-through rate (CTR); and

- cost per click (CPC).

106. Total revenue is given as the total number of searches multiplied by the proportion of searches that show an ad, the number of ads shown per search with an ad, the CTR, and CPC.

107. The proportion of searches with an ad and the average number of ads shown are two measures of ad load.[43] The former captures how many searches out of all searches could generate revenue. The latter, instead, can be seen as a measure of ad intensity.

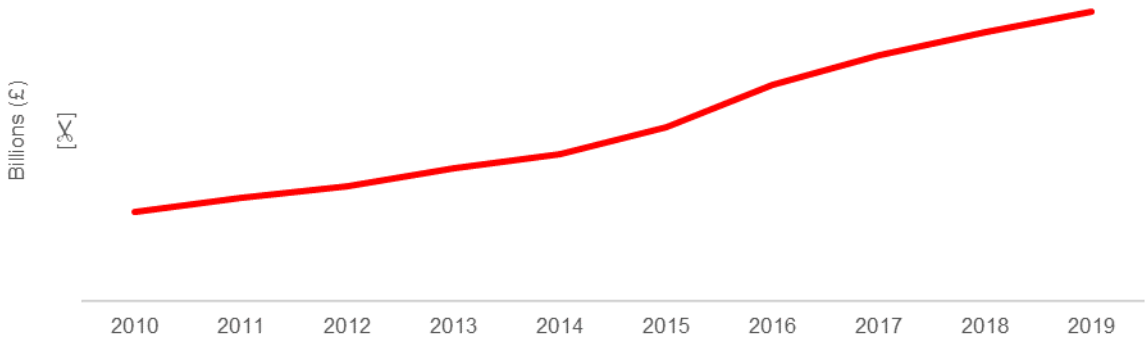
108. The CTR measures the proportion of ads are actually clicked and generate revenue for search providers.[44,45] CPC is a measure of price. It captures how much an ad click costs to an advertiser

109. The metrics in this section show the evolution of these metrics over a 10-year time frame for Google. The benefit of this analysis is that we can compare how Google's outcomes have changed from a long-term perspective.

- *Revenue*

110. Google's revenue has been steadily increasing over the past 10 years from 2010 to 2019, as shown by Figure C.21.

Figure C.23 Total UK Google Search Revenue in real terms (2010-2019)



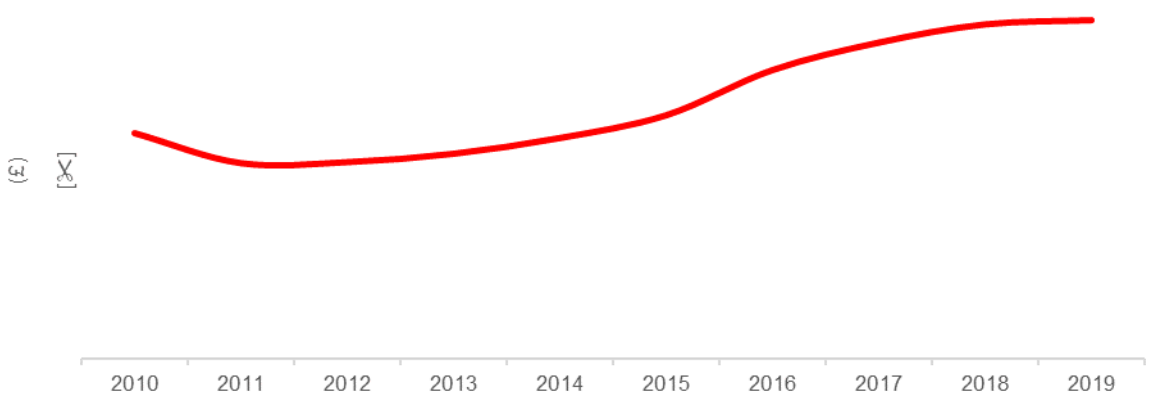
Source: CMA analysis of Google data.

[43] Indeed, the product of these two factors returns the average number of ads shown on all searches (not just searches with ads), which can be seen a summary metric of ad load in search advertising.
[44] Search engines typically charge on a cost per click as shown in Appendix N.
[45] Throughout the rest of this section, we employ different definitions of click-through rate. Unless otherwise specified by click-through rate we mean the proportion of ads that receive a click over the total number of ads in a given set.

111. The increase in Google's revenues is substantial and is in part explained by growth in the total number of searches. However, the increase in revenue has exceeded the growth in the number of searches.

112. Figure C.24 shows that revenue per search has risen. Revenue has increased from a low of £[0.02-0.03] per search in 2011 to a high of £[0.04-0.05] per search in 2019.

Figure C.24: Total UK Google Search Revenue per search in real terms (2010-2019

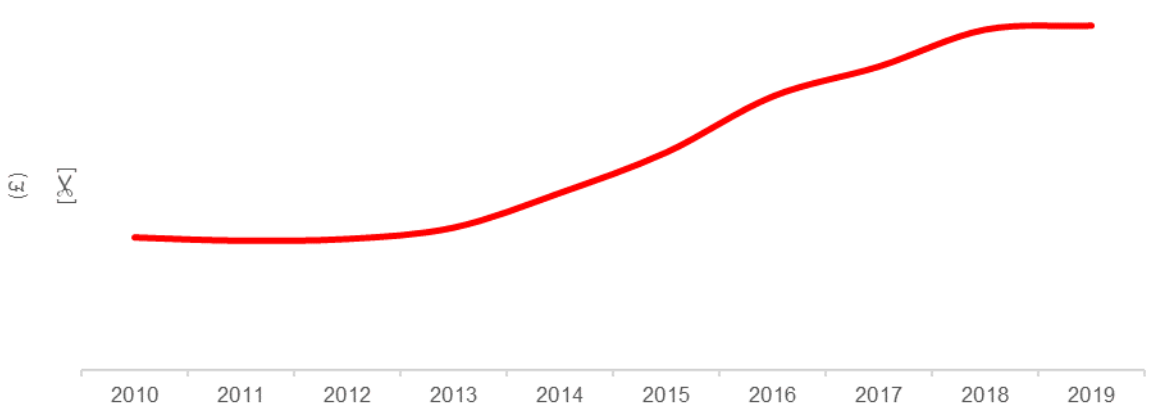


Source: CMA analysis of Google data.

113. Figure C.24 shows Google's revenue per search for only those searches with ads.

114. Revenue per search with ads has increased by around [100-200%] from 2010 to 2019. Over the past 10 years, Google's revenue for searches with ads has increased at a faster rate than Google revenue per search overall. This suggests that Google's monetisation is becoming focused on a smaller proportion of its overall searches over time.

Figure C.25: UK Google Search, Revenue per search with ads in real terms (2010-2019)



Source: CMA analysis of Google data.

115. There are several possible drivers of increased revenue per search, which we consider in more detail below. We look at different measures of ad load, total ad clicks, click-through rates and prices. Finally, we examine internal documents which cover internal analysis undertaken and used to make decisions over how to make changes to the ways in which ads are presented on Google search.

- *Ad load*

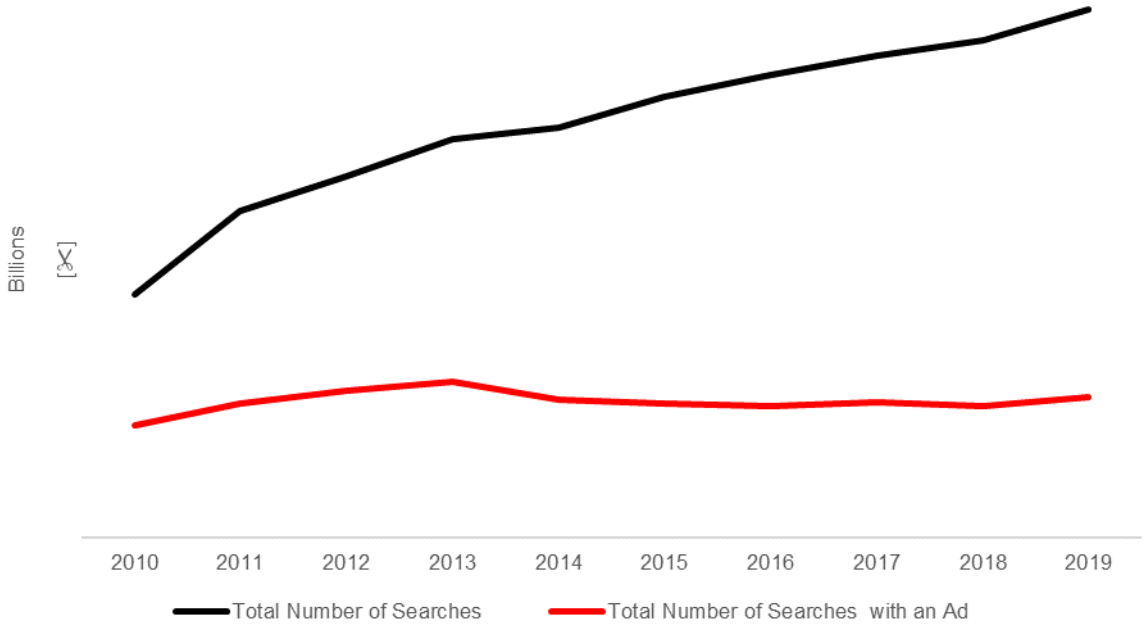
116. One measure of ad load is the proportion of total searches for which ads are shown. This measure shows how the proportion of 'commercial' searches has evolved over time. Another measure of ad load is the number of impressions[46] for search where ads are shown. This shows the ad load for 'commercial' search queries. Looking at both these measures allows us to distinguish between the distribution of ad load across the entire population of Google's search queries and the 'depth' of ad load on those search queries that are 'commercial'.

117. Below we set out the evolution of the proportion of total searches on Google Search for which ads are shown, the total number of impressions and the average number of impressions per search for which ads are shown.

118. Figure C.26 shows the total number of searches from 2010 to 2019. The results are broken down between searches with an ad and searches without an ad.

[46] Impressions measure the total quantity of ad inventory shown to users (regardless of whether users click on ads).

Figure C.26: Total UK Searches on Google Search (2010-2019)

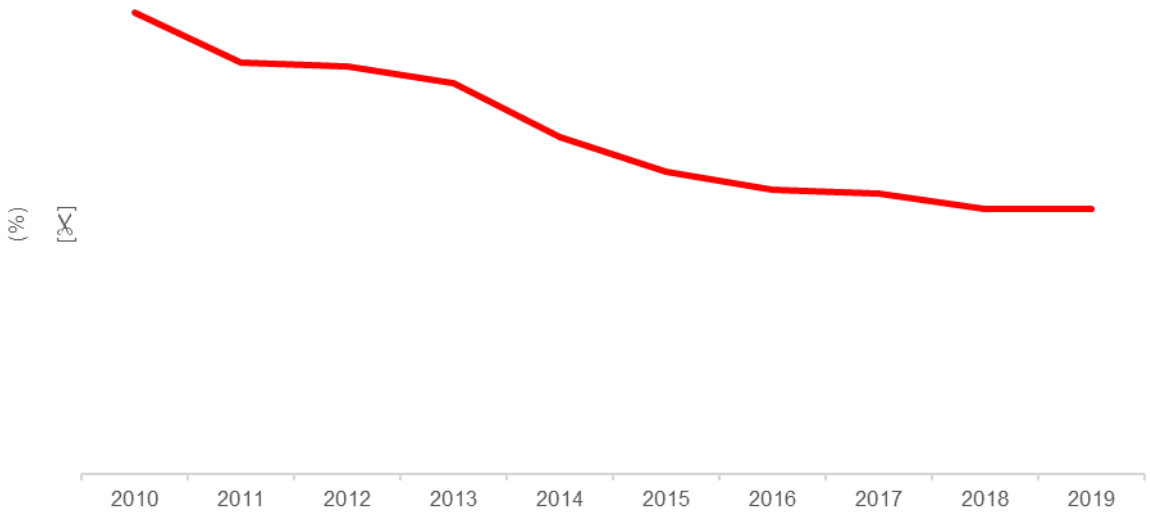


Source: CMA analysis of Google data.

119. Figure C.26 shows that the total number of searches made on Google in the UK has increased substantially from [50-100] billion in 2010 to [150-200] billion in 2019. It also illustrates that the number of searches showing ads has remained relatively stable over the past 10 years. In 2010, there were [30-40] billion searches with an ad, which peaked in 2013 at [40-50] billion searches. Since then the number of searches with an ad has fallen slightly

120. As illustrated further in Figure C.27 below, the proportion of searches with an ad has fallen considerably, from over [40-50%] in 2010 to [20-30%] in 2019.

Figure C.27: Proportion of searches with an ad on Google Search (2010-2019)



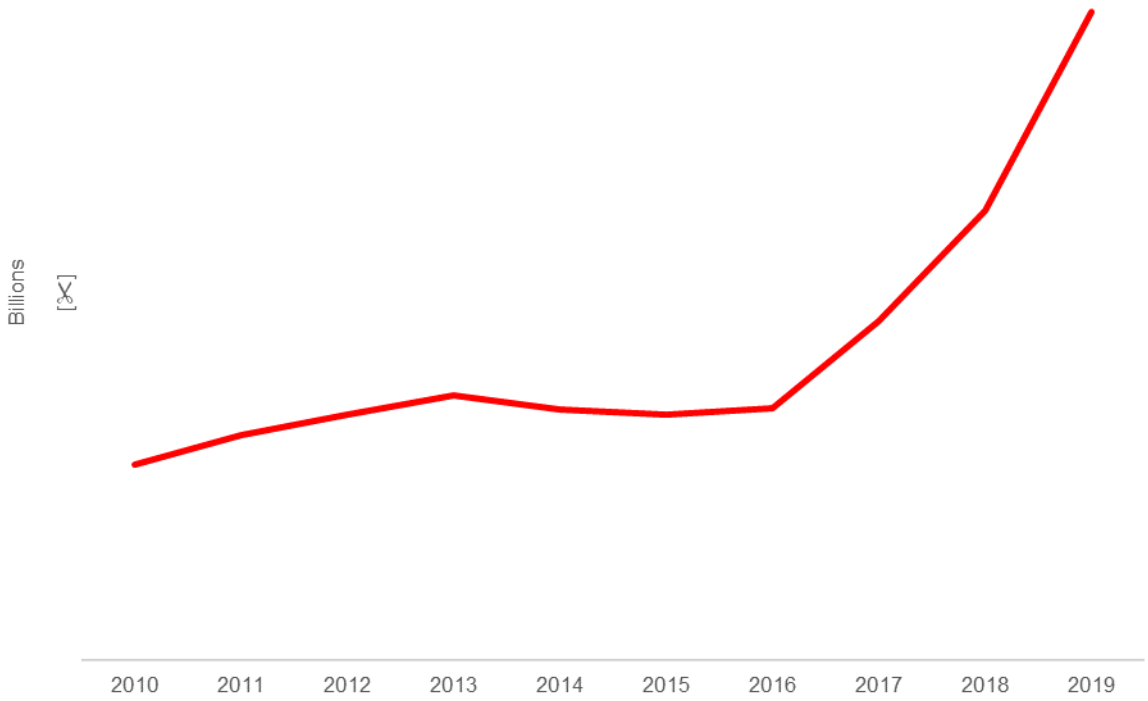
Source: CMA analysis of Google data.

121. Figure C.28 shows the total number of impressions that have been shown to users from 2010 to 2019. Despite a fairly constant number of searches with ads, the number of impressions (including non-text ads[47], both viewed and unviewed[48]) steadily increased from [✂] billion in 2010 to [✂] billion in 2016. After 2016, the growth in the number of impressions accelerated significantly, reaching [✂] billion in 2019.

122. We have been able to break down number of impressions by device type for the past three years. This breakdown shows that the trend has been driven by a particular growth in mobile impressions. We note that Google submitted data which shows that When broken down between PLA and text ads, the increase in recent years has been primarily driven by an increase in PLA ads

[47] For example, Google Shopping Ads
[48] These are impressions that were selected for a page but were never seen because the user did not take the action that would've been required to see them, for example ads included in the horizontally scrollable carousel for PLA even if the user did not scroll to actually view all of the results.

Figure C.28: Total UK Impressions on Google Search, including non-text ads, both viewed and unviewed (2010-2019)



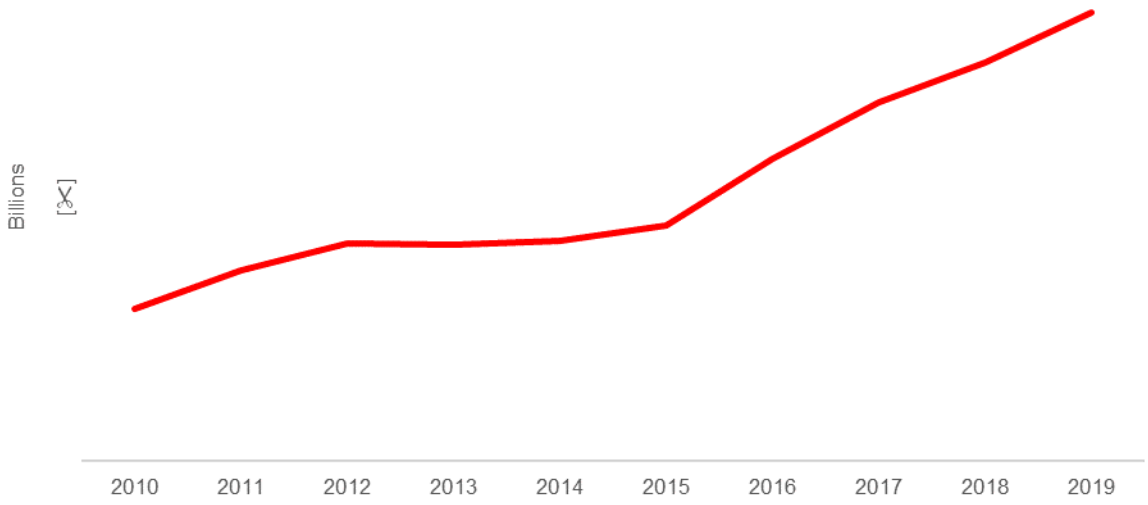
Source: CMA analysis of Google data.

- *Ad Clicks and Click Through Rate*

123. Google predominately uses a cost per click pricing structure to sell its inventory. To understand how impressions lead to increased revenue, we have looked at the extent to which impressions result in clicks, we measure this both in absolute terms, and as a relative to the proportion of searches with an ad. The higher this proportion is, the more searches result in ad clicks.

124. Figure C.29 shows that the volume of ad clicks on Google search in 2019 were around 300% of the volume in 2010. We have been able to break down the total number of clicks by device type for the past three years. This breakdown shows that the trend has been driven by a particular growth in mobile clicks.

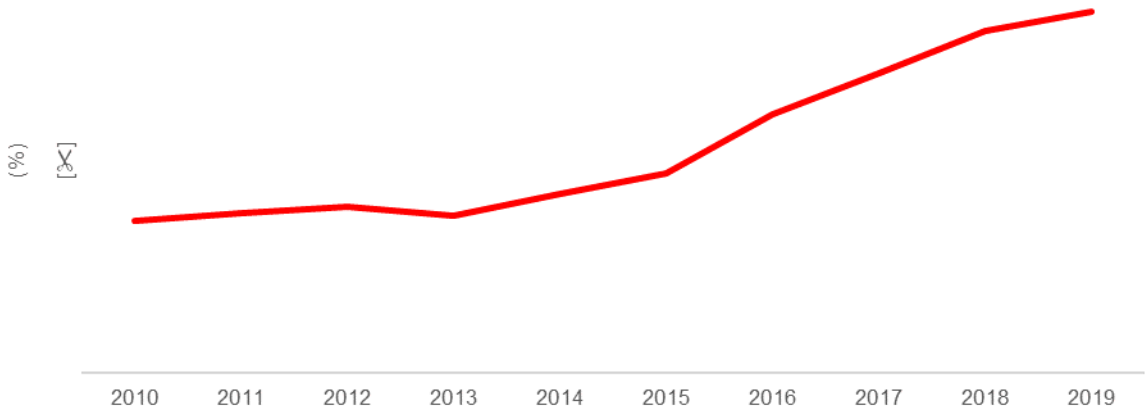
Figure C.29: Total UK Ad clicks on Google Search (2010-2019)



Source: CMA analysis of Google data.

125. Figure C.30 below shows total ad clicks relative to the total number of searches with ads. It shows that the click-through rate has increased substantially since 2010.

Figure C.30: Total UK Ad Clicks as proportion of searches with ads[49] (2010-2019)



Source: CMA analysis of Google data.

126. Table C.5 shows, the average page click-through rates of text ads for 2019, split by the number of text ads shown.

[49] Measured as the proportion of total clicks divided by the total number of searches with ads

Table C.5: UK Ad page click-through rates on Google Search across all device types, 2019

	Number of text ads shown						
	1	2	3	4	5	6	7
Click-through rate of top ad	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Cumulative Click-through rate of all text ads[50]	[✂] [20-30%]	[✂] [20-30%]	[✂] [20-30%]	[✂] [30-40%]	[✂] [30-40%]	[✂] [30-40%]	[✂] [50-60%]

Source: CMA analysis of Google data.

127. This table shows that as the number of ads shown per search increases, the page click-through rate increases, from [20-30]% when only one ad is shown to [50-60]% when seven ads are shown. This may be in part explained by 'crowding out', as an increased number of ads may increase propensity for users to clicks on ads rather than organic links. However, it is important to note that this relationship is likely to be endogenous (circular) as there is also an incentive for Google to show more ads where the propensity for users to click on ads is higher. For example, the propensity for users to click on ads may be inherently higher for more 'commercial' search queries (eg 'cheap insurance'), where ads are likely to be more relevant to users than for less commercial searches.

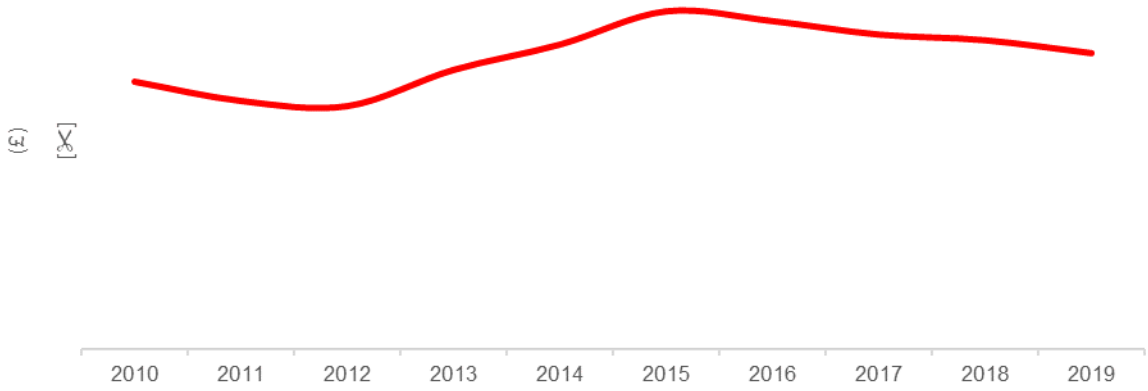
128. The endogenous relationship between the number of ads and the click-through rate makes it difficult to isolate empirically the extent to which there is a crowding out effect.

- *Prices*

129. Figure C.31 shows the cost per click from 2010 to 2019 in real terms. Cost per click has been fairly stable but has increased somewhat over time from a low point in 2012 to a peak in 2015. [✂].

[50] Calculated as the sum of individual click-through rates.

Figure C.31: UK Cost per Click (2010-2019)



Source: CMA analysis of Google data.

Aggregate comparative search trends

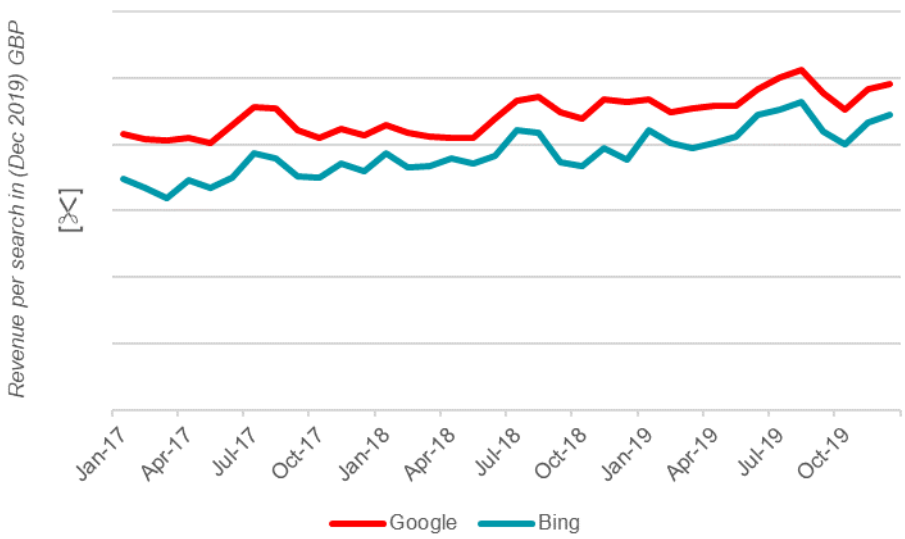
130. In this section, we compare revenue per search and price trends across Google and Bing on a monthly basis over a three-year timeframe. Our results are broken down by device type. The benefit of this analysis is that we can compare changes over time and compare the changes between search engines. However, these aggregate metrics do not control for composition effects which might result from, for example, the different mix of search terms between Google and Bing. Therefore, comparisons between Google and Bing need to be treated with caution.

131. We do not show charts on ad load across Google and Bing, as the data provided by Google and Bing does not appear to be directly comparable. We compare ad load across Google and Bing in our query comparison below.

- *Revenue per search*

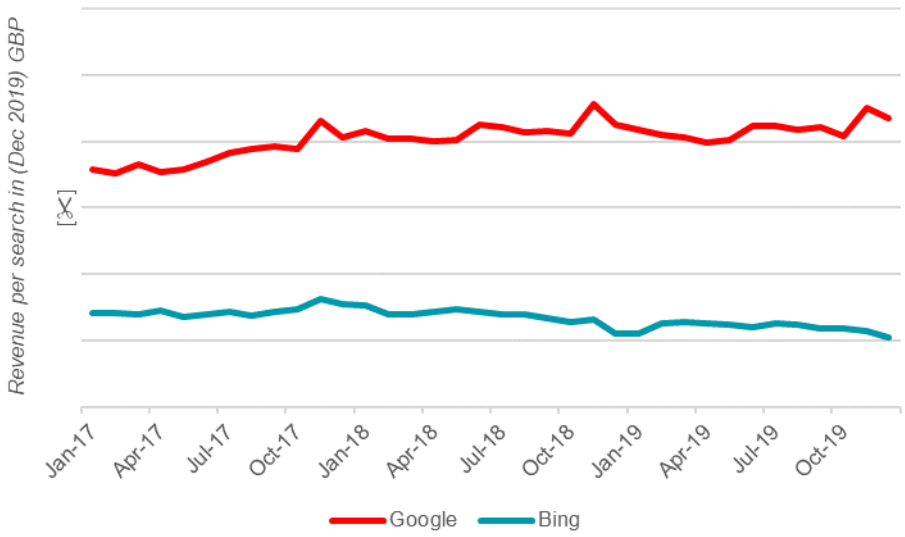
132. Figure C.32 and figure C.33 show how monthly average revenue per search for Google and Bing has changed for desktop and mobile since the start of 2017.

Figure C.32: Monthly average revenue per search, desktop devices (January 2017-December 2019)



Source: CMA analysis of platforms' data.

Figure C.33: Monthly average revenue per search, mobile devices (January 2017-December 2019)



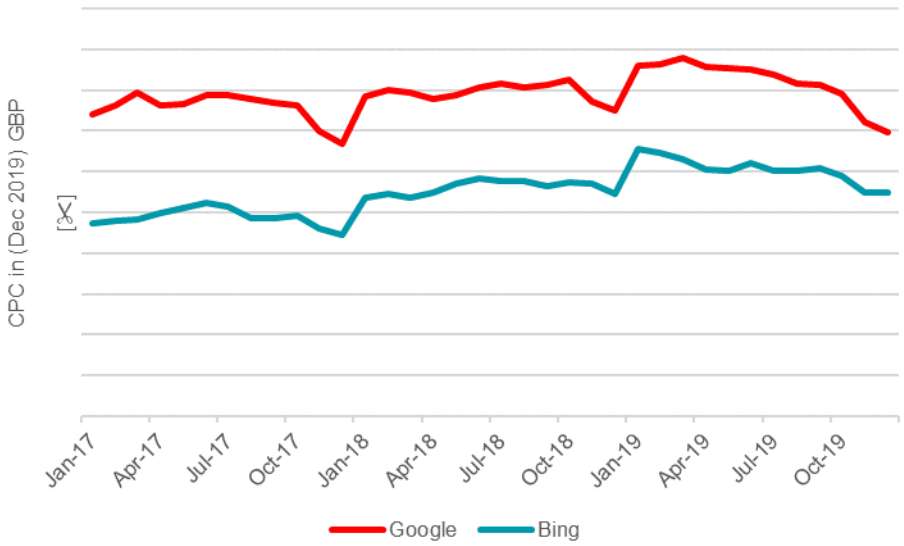
Source: CMA analysis of platforms' data.

133. This shows that both Google and Bing realised higher revenues per search for searches conducted on desktop devices compared to mobile devices. Google had higher revenues per search both at the aggregate level and when considering different device types individually. The gap between Google and Bing was larger for mobile devices (with Google's revenue per search being between [100%-200%] and [300-400%] higher than Bing's) and smaller for desktop devices (with Google's revenue per search being between [5%-10%] and [20-30%] higher than Bing's).

- *Prices*

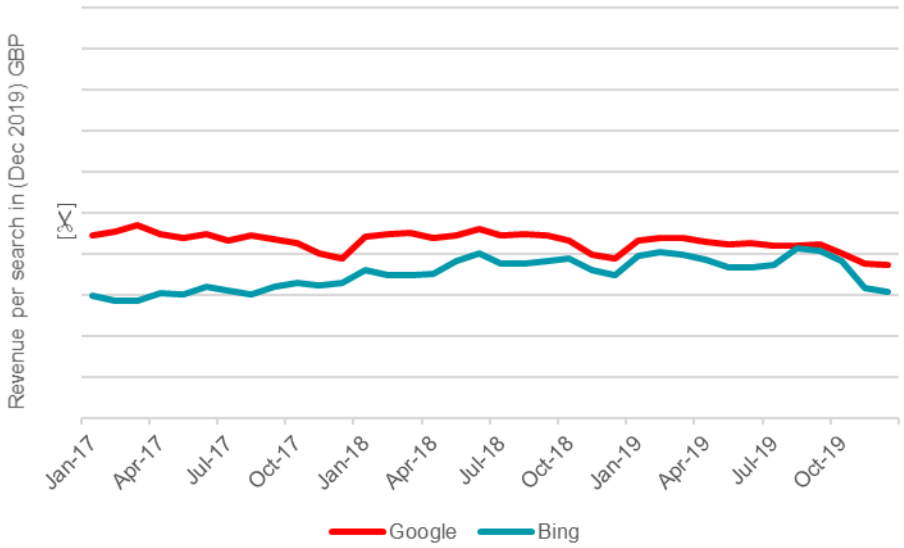
134. We show average monthly CPC for ads monetised on Google and Bing on desktop and mobile devices in Figures C.34 and C.35 below.

Figure C.34: Monthly average CPC for ads monetised on Google and Bing, desktop devices (January 2017-December 2019)



Source: CMA analysis of platforms' data.

Figure C.35: Monthly average CPC for ads monetised on Google and Bing, mobile devices (January 2017-December 2019)



Source: CMA analysis of platforms' data.

135. Average CPCs were higher for ads displayed on desktop than mobile devices for both Google and Bing throughout the whole period considered. However, the difference between prices across the two device types was bigger for

Google than for Bing. CPCs for ads displayed on both desktop and mobile devices were higher for Google than for Bing.

Query comparison

136. In this section, we examine query level data. This takes the population of queries from a single week in 2020 and compares the metrics discussed in previous sections on a like for like basis. This allows for a powerful analysis which compares differences between Google and Bing for the same queries.[51]

137. We received data for approximately 4 billion search events made in the UK on Google and Bing during a single week in 2020. In the analysis that follows, each and every search that is undertaken is counted as a 'search event'. The text that is associated with a search event is a 'query'. The set of queries that remain once duplicates have been removed are 'distinct queries'. Google and Bing did not include the query text in their submissions, to avoid data protection concerns; instead, both parties provided a hashed representation of the query text, including a 'salt[52]' agreed by the parties but unknown to the CMA. As a result, we were able to compare the set of queries seen by the two search engines, without sight of the actual human-readable queries.

138. Our comparison focuses on overlapping queries, that is search events for queries observed by both Google and Bing in the same week. This allows for a 'like-for-like' comparison on a query basis. Carrying out the comparison on like-for-like overlapping queries allows us to isolate differences in market outcomes, rather than capturing differences in the scale or distribution of queries across Google and Bing. Differences in outcomes between Google and Bing at the query level may be in part driven by a range of factors that our analysis is not able to control for. These factors include differences in advertiser or audience composition or differences in technological functionality on Google and Bing.

- *Aggregate descriptive statistics*

139. In this section we show some simple descriptive statistics to understand what the data shows at an aggregate level.

140. The proportion of Google's head queries seen by Bing and of Bing's head queries seen by Google, is close to 100%. This means that the most common

[51] Google submitted money figures to the CMA in USD, while Microsoft submitted GBP amounts. We present the analysis is GBP, after converting the Google USD amounts into GBP using the Bank of England average exchange rate (XUMAUSS) for the month when the data was collected.
[52] Salt is a step which introduces random coding to prevent the CMA from backwards inducing query text.

queries in the two engines tend to be seen by both. For a small section of the Bing distribution, around the 25th percentile, the proportion of search events for queries that are also seen by Google is slightly lower than the proportion of Google search events that are also seen by Bing.

Figure C.36: Share of search events and revenue

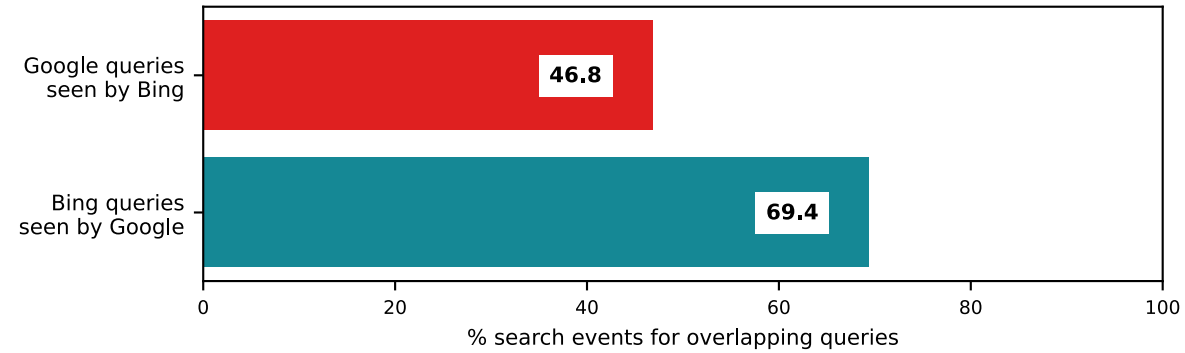
[✂]

Source: CMA analysis of parties' data.

141. Figure C.36 shows that Google has a similar share of the market [90-100%]) both in terms of the volume of search events and in terms of revenue from these events. This is consistent with our estimates for revenue shares for 2019 as a whole.

142. Figure C.37 shows the proportion of search events that were for queries that appear in both Google and Bing (overlapping queries). For Google this shows the proportion of search events that were for queries that Bing sees as well. For Bing this shows the proportion of search events that were for queries that Google sees as well.

Figure C.37: Proportion of search events for overlapping queries



Source: CMA analysis of parties' data.

143. A lower proportion (47%) of search events that take place on Google are for queries that overlap with Bing. A higher proportion (69%) of search events that take place on Bing are for queries that overlap with Google. In combination, this means that around 48% of all search events are overlapping.

144. Looking at the aggregate level we are able calculate the revenue per search for Google and Bing. This is a measure of the result of ad load, click through rates and price per click over all queries (overlapping and non-overlapping) that Google and Bing see. Results are broken down by mobile and desktop.[53]

[53] We have excluded tablet observations from this analysis.

Table C.6: Aggregate Revenue per search

	Desktop	*Mobile*
Google	[✂]	[✂]
Bing	[✂]	[✂]

Source: CMA analysis of parties' data.

145. This table describes revenues at an aggregate level but does not control for the fact that Google and Bing observe a different set of queries. Google and Bing both make higher revenue for each search on desktop compared to mobile. Bing earns slightly more than Google on average for desktop searches. However, on mobile Google earns on average around three times as much as Bing for each search.

- *Revenue per search – a like-for-like comparison*

146. To produce the estimates in this section, we consider only desktop and mobile searches during the week of data that was submitted to us – excluding tablets. We exclude all blank queries and all queries that have been identified as spam by Google and Bing. We only consider search events for queries that have been searched on both Google and Bing (overlapping queries) on each of desktop and mobile. For example, if "pear" is searched once on mobile Google, twice on desktop Google, once on desktop Bing, but never in mobile Bing, we include the query "pear" only in the desktop column. To compute the averages that correspond to the height of each bar, we adopt the following procedure. For each distinct query (eg "cheese" and "pear"), we compute the average of the outcome (eg revenue, ad load, or prices) across all search events in each engine that correspond to that query. Then, we take the average of the outcome across all distinct queries, weighting by the total frequency of that distinct query, ie the number of times it appears across both engines. This is to assign a higher weight in the average to queries that are more commonly searched by UK users.

147. A practical example of a fictional dataset is set out in the Annex below.

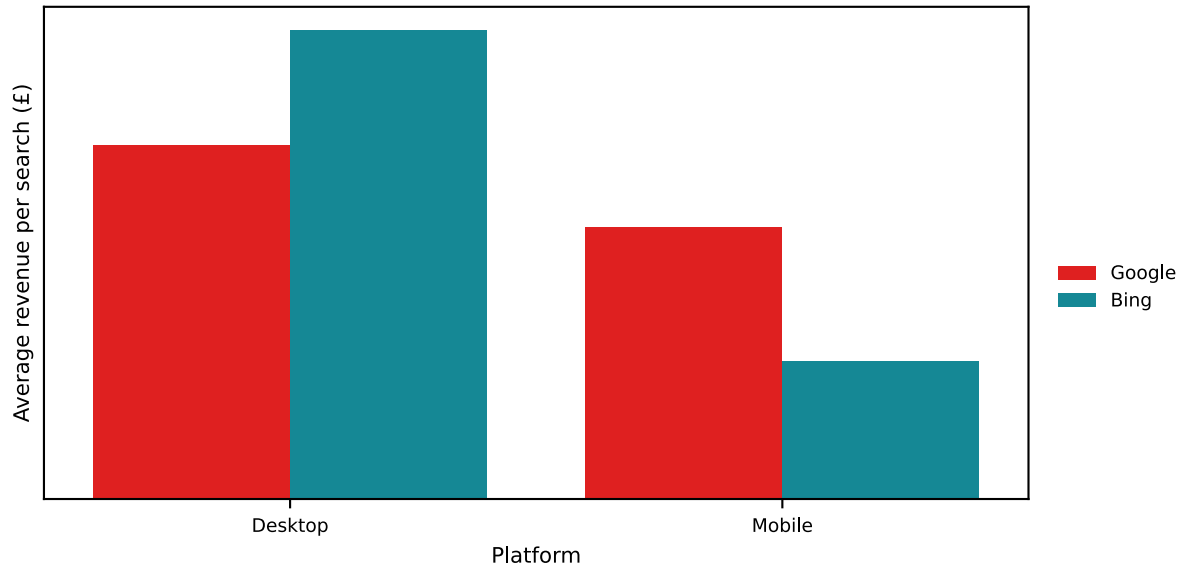
148. Restricting our focus on overlapping queries allows us to compare outcomes for Google and Bing abstracting from the fact that the two search engines observe different queries.[54] We have compared the average revenue per search on this basis to measure as revenue relative to the total number of search events per query.

149. Figure C.38 shows the average revenue per search for Google and Bing on a like-for-like basis across all overlapping queries (including those which do not

[54] That is, queries that were observed on mobile and desktop by each of Google and Bing.

show ads). This graph shows that Bing makes more revenue per search than Google on desktop, but that Google makes more revenue per search on mobile.

Figure C.38: UK Average revenue per search (£) on a like-for-like basis

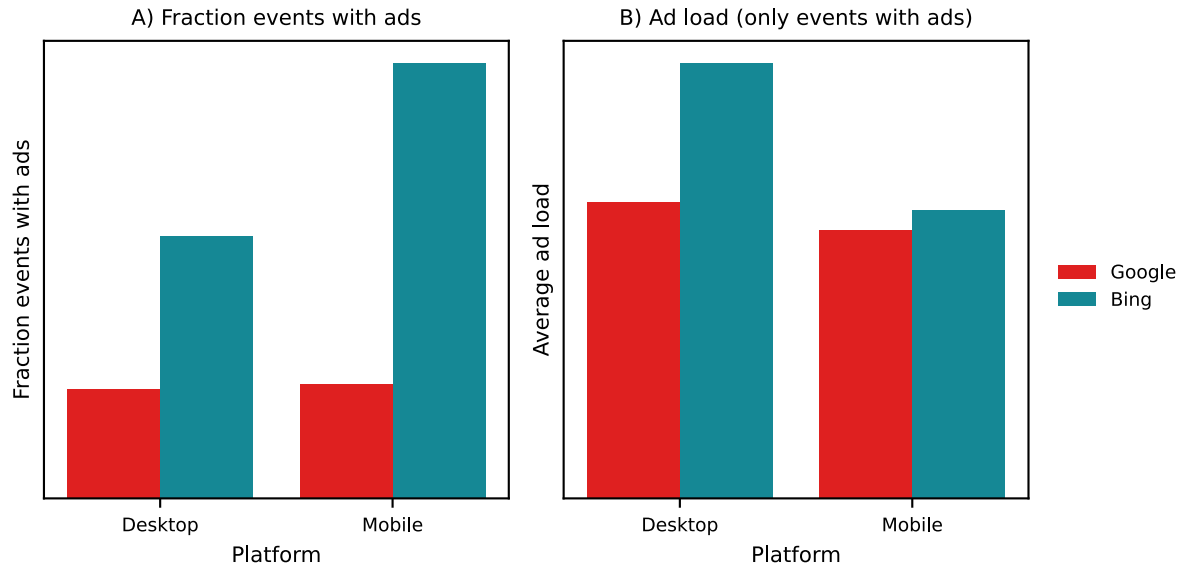


Source: CMA analysis of parties' data.

- *Ad load*

150. Figure C.39 shows the proportion of search events where an ad is shown on a like-for-like basis (panel A), and the average number of ads shown for events that show at least one ad (panel B).

Figure C.39: proportion of search events that show ads and ad load for Google and Bing on a like-for-like basis



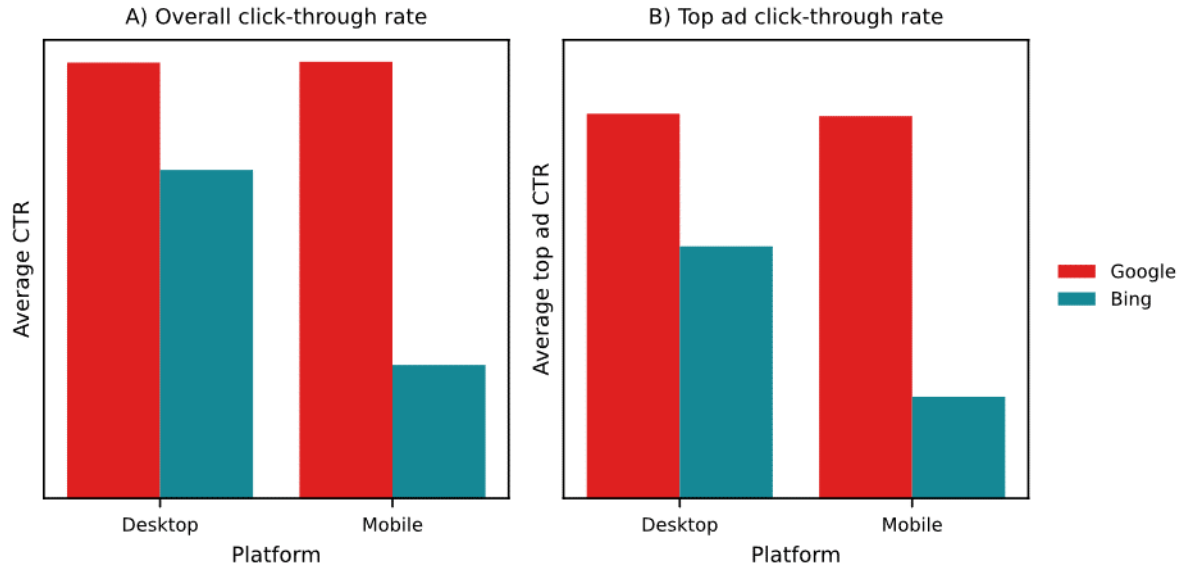
Source: CMA analysis of parties' data.

151. Figure C.39 shows that, compared to Bing, Google has a lower ad load both in terms of the number of search events which show an ad and the number of ads shown on each of these events. This comparison does not include other specialised search adverts, such as Google Shopping ads, which contribute to Google's overall ad load.

- *Click-through rates*

152. We have calculated the average click-through rates for like-for-like queries that appear on both Google and Bing. Panel A of Figure C.40 shows click-through rates[55] of search events on a like-for-like query basis.

Figure C.40: average click-through rates for Google and Bing on a like-for-like basis



Source: CMA analysis of parties' data.

153. We have obtained price information only for the top text ad in each search event. Panel B of Figure C.40 shows the same click through rates as panel A, but limited to the top text ad.

154. This shows that compared with Bing, top ads on Google are more likely to attract clicks. This may reflect that Google's data advantages from greater scale of user search queries mean that its ads have higher relevance than Bing. It may also reflect that Google is better able to 'nudge' users to click on ads.

- *Prices*

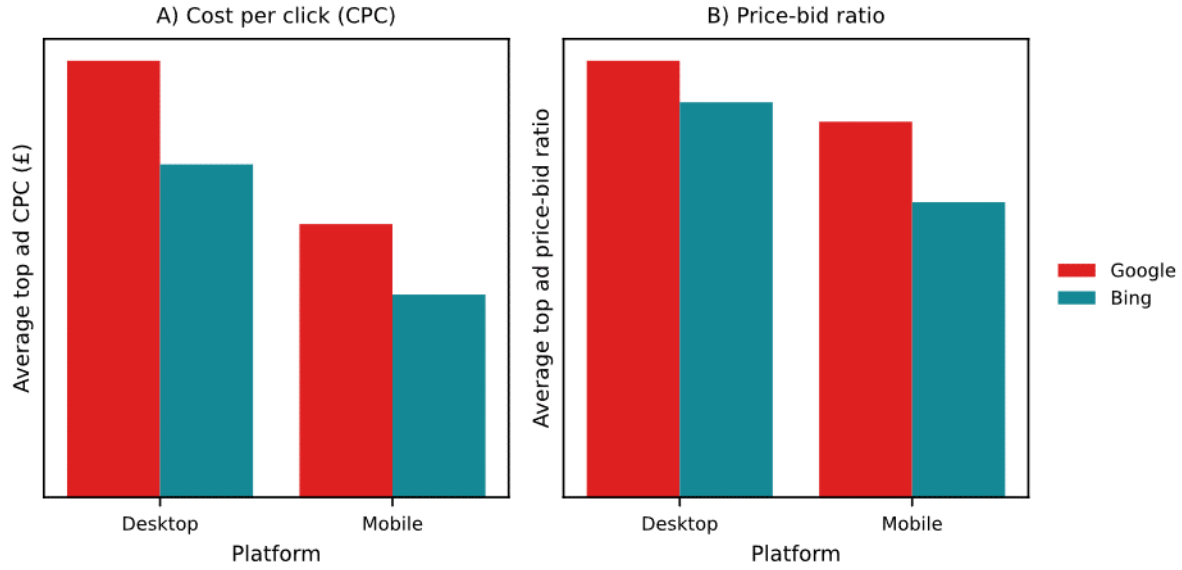
155. In this section we look at the differences in cost per click for like-for-like queries for Google and Bing. To ensure our comparison is drawn on a

[55] Average click through rates are calculated as the proportion of ads that are clicked on relative to all ads shown

comparable basis we restrict the analysis to the cost per click of the top ad for both Google and Bing for overlapping queries.

156. Panel A of Figure C.41 shows cost per click of top ads on a like-for-like basis.

Figure C.41: Average top ad cost per click and price-bid ratio on Google and Bing



Source: CMA analysis of parties' data.

157. This chart shows that for the same queries, Google has a higher price than Bing. Compared to Bing, Google prices are around [30-40]% higher on desktop and [30-40]% higher on mobile. This is consistent with Google benefiting from data or scale advantages or from exploiting market power through the use of levers in its search auctions, such as reserve prices, as described above. Alternatively, these differences may have been caused through differences from users or advertisers.

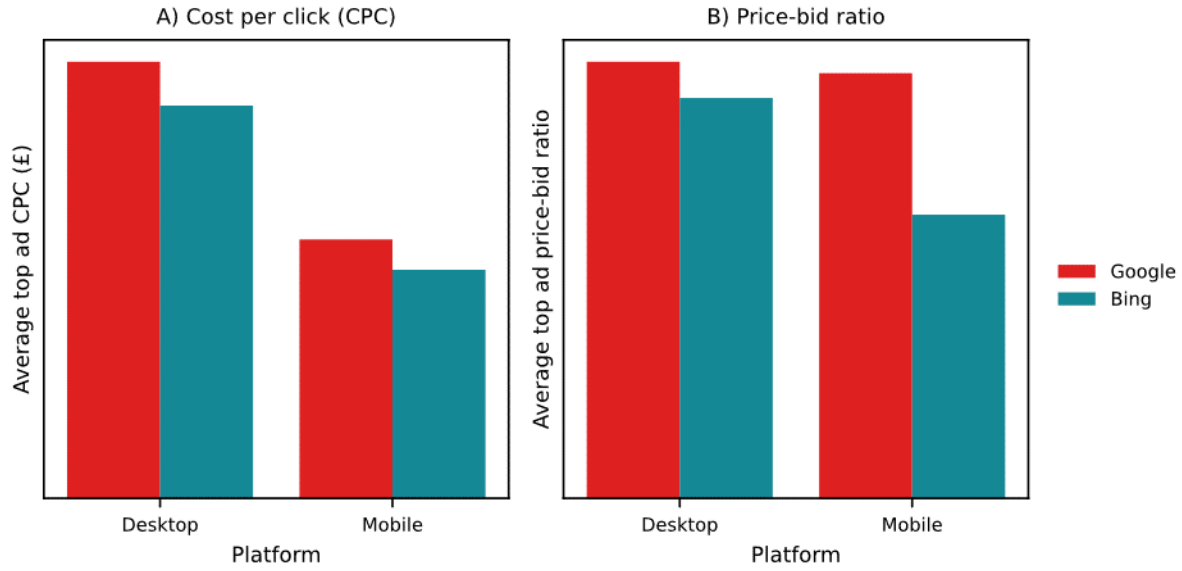
- *Price-bid ratio*

158. The price-bid ratio measures the difference between the winning bid and the price paid. It therefore gives an indication of the efficiency of the auction from the platform's perspective ie its ability to extract more advertiser spend. Insofar as the bid is an indicator of the advertiser's willingness to pay (ie the value it derives from a click), the price-bid ratio helps to control for any difference in the value of a click on Google as opposed to Bing.

159. We have compared the price-bid ratio for like-for-like search queries across Google and Bing. Due to the nature of the comparison, this data is restricted to overlapping queries where the top ad was clicked for both Google and Bing.

160. Panel B of Figure C.41 shows the difference in price-bid ratio between Google and Bing for top ads. It shows Google has a higher price-bid ratio for like-for-like queries on average, by [10-20]% on desktop and [20-30]% on mobile for the sample of queries that we analysed.

Figure C.42: Average top ad cost per click and price-bid ratio on Google and Bing, unweighted



Source: CMA analysis of parties' data.

161. Finally, Figure C.42 presents the same average price estimates as Figure C.41, but without weighting for query frequency – thus assigning the same importance to each distinct overlapping query regardless of how many times it was searched for. The fact that the unweighted estimates of CPC are higher than the ones weighted for query frequency indicates that less common queries have higher CPC on average.

Display advertising

162. In this section we present our analysis of advertiser outcomes in the UK display advertising sector. First, we present our estimates for its overall size and its main players' shares of advertiser expenditure. We then analyse monetisation trends over time.

- *Sources of data*

163. Our primary source of data consists of the datasets we received from the parties in response to our information requests, along with the accompanying explanatory notes and the responses to our related clarification questions.

164. We received annual and monthly datasets from the following owned and operated platforms:

- Amazon;
- Facebook (inclusive of data on Instagram);
- Google (consisting of data on YouTube);
- Microsoft (consisting of data on LinkedIn);
- Pinterest;
- Snapchat;
- ByteDance (consisting of data on TikTok); and
- Twitter.

165. The annual datasets generally include information on revenue, number of advertising impressions and average number of monthly active users (MAUs). The monthly data, although typically provided for a shorter timeframe, entails a higher level of granularity and includes information on digital advertising revenue, number of advertising impressions, user actions (eg number of clicks and number of conversions) and user time spent, according to a number of splits, such as device type, creative type (video vs. non-video) and pricing model. [56, 57, 58]

166. Facebook provided more granular monthly data than the other platforms, including revenue, number of impressions and user action metrics broken down by advertiser objective. This has allowed us to analyse Facebook's revenue trends in greater detail.

167. We requested data for the UK only. Some of the parties attributed their data to the UK based on advertisers' billing address, while others did so on the basis of users' location. While this poses potential issues in terms of the comparability of the datasets, we have sought to ensure the maximum level of

[56] Not all parties have been able to provide data for the entire time period (2010-2019 for the annual data and January 2016-December 2019 for the monthly data), all the metrics and/or all the splits requested, for example because they do not retain such data in their systems or because some of the metrics and/or the splits requested are not applicable to their business. In the analysis we present below, we have sought to provide the most complete metrics we have been able to estimate with a reasonable level of accuracy from the data in our availability.
[57] Pinterest did not provide annual revenue and impressions figures. YouTube did not provide annual data.
[58] We asked platforms to self-classify ad formats into video and non-video.

comparability given the data available. We favour the user location approach when possible.[59, 60]

168. A number of parties emphasised to the CMA that the most recent 2019 data had been provided to the CMA in good faith but had not been audited and would not normally be released by the party (including on a UK regional basis).

The size of the UK display advertising sector and its main players

- *Methodology*

169. First, we have estimated the size of the owned and operated channel in terms of advertisers' expenditure. Then, we have added this to our estimate for the overall size of the open display channel (set out in more detail below) to compute the total size of the UK display advertising. Finally, we have computed individual platforms' expenditure shares as expenditure on each platform over total display advertising expenditure.

170. We have used advertisers' expenditure rather than the parties' revenue as a measure of size in order to make like-for-like comparisons across the owned and operated and open display channels. This has the effect of including the fees charged by intermediaries in the open display channel for services that are similar to those provided in-house by owned and operated platforms. For owned and operated platforms, advertisers' expenditure and platforms' revenues are equivalent, as, by definition, no intermediaries are involved.[61]

171. To estimate the size of the owned and operated display channel we have summed the revenue generated by each platform from the sale of display advertising on its own properties. We have excluded platforms that, in addition to their own sale channels, make their inventory available to advertisers through third-parties intermediaries (eg Verizon Media and Tumblr).[62]

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[59] Twitter and Microsoft provided data on the basis of believed advertiser location. Twitter specified that they attributed data to the UK on the basis of believed advertiser location. Facebook provided data on the basis of advertiser location in the monthly dataset and on the basis of user location in the annual dataset. Amazon provided data on the basis of the country targeted by the advertiser, which generally corresponds to the location in which the ad is served (and therefore to user location). All the other parties provided data on the basis of user location.
[60] Snapchat specified that it provided data on the basis of 'the limited user location', ie where location data was voluntarily provided by its users.
[61] For both the owned and operated and open display channels we have excluded media agency and advertiser ad server fees.
[62] Expenditures on these parties is included in our estimate for the size of the open display channel.

172. The platforms we have considered are:

- Amazon;
- Facebook
- Instagram;
- YouTube;
- LinkedIn;
- Pinterest;
- Snapchat;
- TikTok; and
- Twitter.

173. Whenever possible we have used annual data, as we generally deem it more reliable than the monthly data.[63] This is not possible when estimating the size of display advertising split into video and non-video advertising, as the parties provided only aggregate revenue in the annual data. Hence, for the video/non-video split we have relied on monthly data.

174. For Facebook, Instagram, LinkedIn and Twitter we have not been able to reconcile apparent discrepancies between total advertising revenue as reported in the annual data and the sum of video and non-video advertising revenue as computed by aggregating the monthly revenue data at the year level for 2018 and 2019.[64] For these platforms, we have used the monthly data to compute the relative proportion of revenue derived from video. We have then estimated video advertising revenue by rescaling total revenue as reported in the annual data by this proportion. We have proceeded analogously for non-video.[65]

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[63] For our aggregate estimates, we have used monthly data for Amazon, YouTube and Pinterest. Amazon's annual data does not split into Amazon's own properties and third-party inventory. Google did not provide annual data for YouTube. Pinterest did not provide annual revenue data.
[64] For Facebook and Instagram, this is due to the fact that Facebook attributed revenue to the UK on the basis of user location in the annual data and on the basis of advertiser location in the monthly data. LinkedIn provided revenue data as derived from internal gross bookings in the monthly dataset and from net bookings in the annual data. Twitter has not been able to split revenue into video and non-video for some of the periods recorded in the monthly dataset.
[65] We notice that for Facebook, annual revenue as reported in the annual data is greater than monthly revenue as reported in the monthly data aggregated at the year level for both 2018 and 2019.

175. Some of the platforms provided revenues expressed in US$. We have converted revenues to GBP using the Bank of England reported US$ into GBP annual average spot exchange rate (XUAAUSS) for the annual data and using the bank of England reported US$ into GBP monthly average spot exchange rate (XUMAUSS) for the monthly data.[66, 67]

176. We have converted revenue figures from nominal to real to ensure figures can be compared across different time periods.[68]

177. We have readjusted our estimates for the size of the open display channel (introduced in the section on the open display channel below) to exclude advertiser ad server and media agency fees. We have done so in order to ensure comparability with the owned and operated channel.

178. The data we have available does not allow us to split expenditure in the open display channel between video and non-video without making strong assumptions. For this reason, we have applied the IAB's 2019 percentage revenue breakdown into video and non-video for 'non-social' display to our estimate for the overall size of the open display channel (net of advertiser ad server and media agency fees). The IAB estimates the size of 'non-social' display advertising to be £2.6 billion in 2019, 23% of which is attributable to video and 77% to non-video.[69]

- *Outcomes*

179. Following the methodology outlined above, we have produced an estimate of £3.8 billion for the size of the UK owned and operated display advertising in 2019. Our estimate is similar to the IAB's figure for the size of 'social display' advertising of £3.6 billion.

180. Our estimate of the size of the open display channel net of advertiser ad server and media agency fees for 2019 is £1.8 billion. Adding this to our

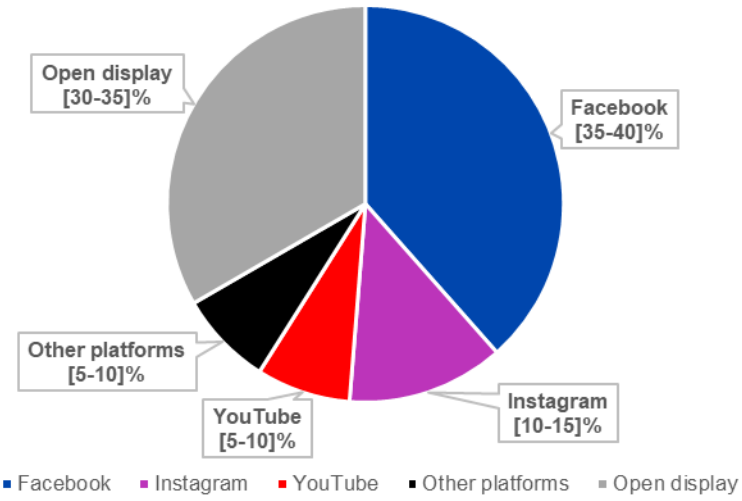
[66] Twitter revenue figures were billed in different currencies and then converted to US$ on the basis of a fixed exchange rate as of 31/12/2019. The vast majority of the revenue over the requested timeframe was billed in GBP, hence we have converted figures from US$ to GBP by applying the Bank of England XUDLUSS dataset US$ into GBP spot exchange rate for 31/12/2019.
[67] Amazon is the only party that reported revenue in GBP.
[68] We have used 2019 as a base period for the annual data and December 2019 for the monthly data. We have used the Office for National Statistics All Items CPI Index 00 (D7BT/MM23) as a source of general price levels in the UK economy.
[69] See IAB (2019) for more information on the IAB estimates.

estimate of the size of the owned and operated channel, this has led us to estimate the overall size of the UK display advertising sector at £5.5 billion.[70]

181. According to our estimates, the UK display adverting sector has grown by around 16% from 2018 to 2019. This growth has been driven largely by the owned and operated channel, which has expanded by around 24% with respect to the £3 billion figure we have estimated for 2018 (see Table C.7). We examine the drivers underlying this growth in the monetisation trends section below.

182. Figure C.43 shows individual platforms' shares of advertising expenditure and the share of expenditure on the open display channel as a proportion of the overall size of the display advertising sector in 2019.

Figure C.43: Shares of expenditure in UK display advertising (2019)



Source: CMA analysis based on parties' data.
Note: Segments shown in the chart are illustrative, based on mid-points of the stated ranges rather than actual revenue figures. The 'other platforms' segment includes: Amazon, LinkedIn, Pinterest, Snapchat, TikTok and Twitter, each of which have shares in the range [0-5]%.

183. As shown in Figure C.43, in 2019 Facebook was by far the largest player in the UK display advertising sector. Including Instagram, its share of expenditure amounted to [50-60]% of UK display advertising. The second largest share of expenditure ([30-35]%) was captured by the open display channel, followed by YouTube with a share of [5-10]%. The remaining [5-10]% of expenditure was divided among the other owned and operated platforms.

[70] Following our interim report, we have changed the methodology used to estimate the size of open display, and this has an impact on these figures. As a result, these figures are not directly comparable with those in the interim report.

184. The results presented above do not distinguish between video and non-video advertising. Following the methodology outlined in the previous subsection, we have estimated the size of the of the UK video owned and operated and open display advertising in 2019.Table C.7 below presents our results.[71]

Table C.7: Estimated size of the UK display advertising split by video and non-video (2018-2019)

2019 GBP (bn)						
Year	*2019*			*2018*		
Channel						
	Total	*Video*	*Non-video*	*Total*	*Video*	*Non-video*
Owned and operated	3.8	1.9	1.9	3.0	1.5	1.6
Open display	1.8	0.4	1.4	1.8	0.4	1.4
Total	5.5	2.3	3.3	4.8	1.9	2.9

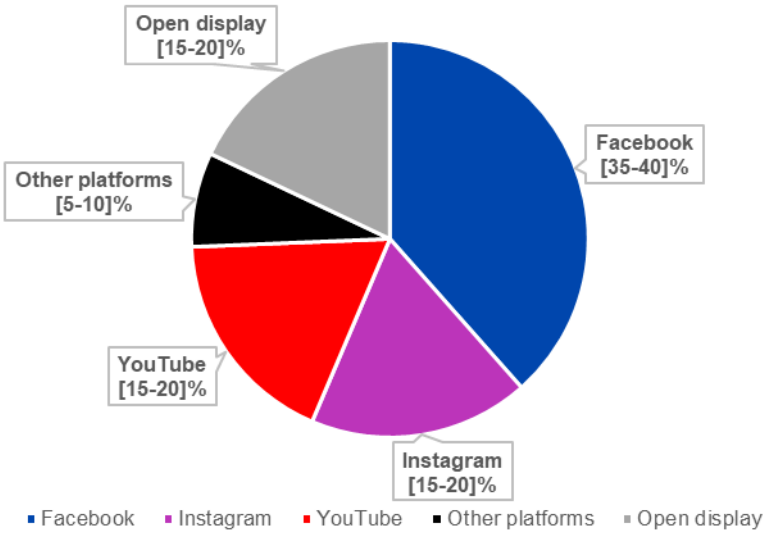
Source: CMA analysis.
Note: Totals might differ from sum of individual figures due to rounding.

185. Table C.7 shows that the share of video as a proportion of the overall size of the UK display advertising has remained roughly stable from 2018 to 2019 (around 40%). This applies also when looking at the owned and operated and the open display channels individually.

186. Figure C.44 shows the individual platforms' shares of advertising expenditure and the share of expenditure on open display as a proportion of the overall size of the UK online video display advertising sector in 2019.[72]

[71] The methodology used to estimate the size of UK video display advertising is different from that used in our interim report. In particular, for those platforms that provided this split on the basis of advertiser location data, we have applied the proportion of video and non-video revenue to the aggregate level. In addition, we have changed the methodology to estimate the size of open display and this has an impact on these figures. As a result, these figures are not directly comparable with those in our interim report.
[72] Facebook's video/non-video advertising revenues are calculated by taking its total UK ad revenues based on user location, and applying a video/non-video split based on advertiser location. As Facebook's revenues based on advertiser location in the UK are lower than those based on user location in the UK, annual revenue as reported in the annual data (based on user location) is greater than monthly revenue as reported in the monthly data (based on advertiser location) aggregated at the year level for both 2018 and 2019.

Figure C.44 Shares of expenditure in UK online video display advertising (2019)



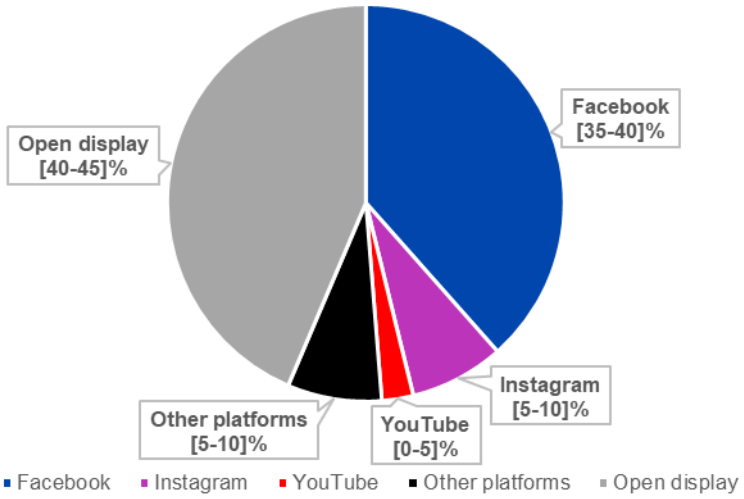
Source: CMA analysis based on parties' data.
Note: Segments shown in the chart are illustrative, based on mid-points of the stated ranges rather than actual revenue figures. The 'other platforms' segment includes: Amazon, LinkedIn, Pinterest, Snapchat, TikTok and Twitter, each of which have shares in the range [0-5]%.

187. As shown in Figure C.44, in 2019 Facebook was by far the largest player in UK online video display advertising; including Instagram, its share of expenditure amounted to [50-60]% of the UK online video display advertising. The second largest share of expenditure was captured by the open display, with a share of [15-20]%; followed by YouTube, with a share of [15-20]%. The remaining [5-10]% of expenditure was divided among the other owned and operated platforms.

188. Figure C.45 shows the individual platforms' shares of advertising expenditure and the share of expenditure on the open display channel as a proportion of the overall size of the UK non-video display advertising in 2019.[73]

[73] Facebook's video/non-video advertising revenues are calculated by taking its total UK ad revenues based on user location, and applying a video/non-video split based on advertiser location. As Facebook's revenues based on advertiser location in the UK are lower than those based on user location in the UK, annual revenue as reported in the annual data (based on user location) is greater than monthly revenue as reported in the monthly data (based on advertiser location) aggregated at the year level for both 2018 and 2019.

Figure C.45 Shares of expenditure in the UK non-video display advertising (2019)



Source: CMA analysis based on parties' data.
Note: Segments shown in the chart are illustrative, based on mid-points of the stated ranges rather than actual revenue figures. The 'other platforms' segment includes: Amazon, LinkedIn, Pinterest, Snapchat, TikTok and Twitter, each of which have shares in the range [0-5]%.

189. As shown in Figure C.45, in 2019 Facebook was the largest player in the UK non-video online display advertising sector, even if it had a smaller share than in video ([40-50]% including Instagram). The second largest share was captured by the open display channel ([40-45%]), while YouTube's share ([0-5]%) was only a fraction of its share in video. The remaining [5-10]% of expenditure was split between the other owned-and-operated platforms.

Monetisation trends

190. In this subsection we examine how display platforms' revenues have changed over time. We also examine the drivers of revenue trends by breaking down revenue into some of its most important components.

191. A platform's digital advertising revenue in any given period can be broken down into the number of advertising impressions monetised and their average unit price in that period.

$$Revenue = number\ of\ monetised\ impression \cdot \\ \cdot\ average\ unit\ price\ of\ all\ monetised\ impressions.$$

192. In turn, the number of monetised impressions can be seen as the result of the interaction of a number of factors, such as the number of active users, the average time users spend on the platform and, depending on the pricing model (eg cost-per-mille or cost per click), the average number of impressions users are shown or engage with in a given time unit (eg impressions per user hour).

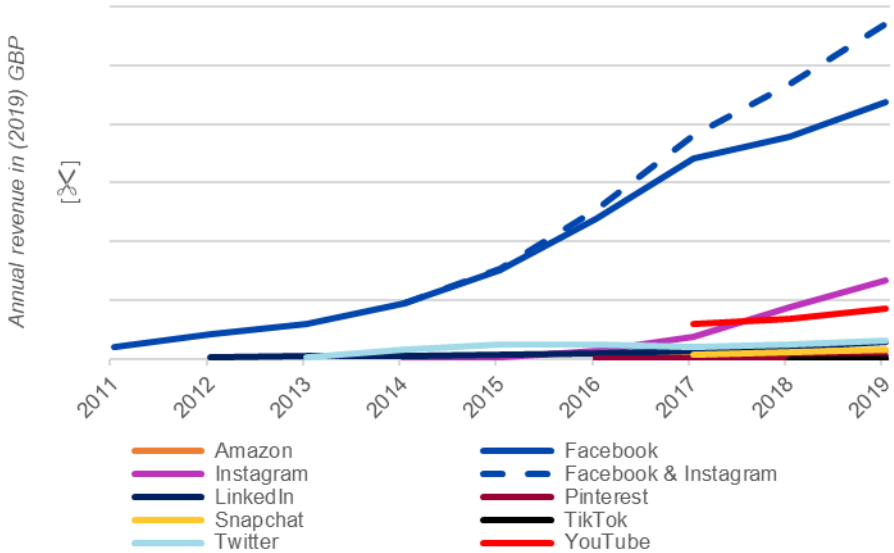
$$Number\ of\ monetised\ impressions =$$
$$= number\ of\ users \cdot$$
$$\cdot\ average\ number\ of\ hours\ spent\ on\ the\ platform\ per\ user \cdot$$
$$\cdot\ average\ number\ of\ monetised\ impressions\ per\ user\ per\ hour.$$

193. In what follows, we set out our main results from the advertising-side perspective. We show the evolution of revenue and its components, together with some important metrics that can be derived from their interaction. First, we present our findings on revenue-related metrics, followed by impression-related metrics and pricing metrics, focusing particularly on Facebook. User-side metrics are discussed in the Consumer Outcomes section of this appendix. Appendix Q links the user and the advertising sides and presents our overall narrative on platforms' exploitation of market power.

- *Revenue-related metrics*

194. Figure C.46 shows the evolution of owned and operated display adverting platforms' annual revenue over time.[74, 75]

Figure C.46: Annual UK owned and operated display advertising gross revenue for selected platforms (2011-2019)



Source: CMA analysis based on parties' data.

195. In the whole period considered, Facebook had by far the largest revenue. In 2018, Instagram overtook YouTube, thus becoming the second largest

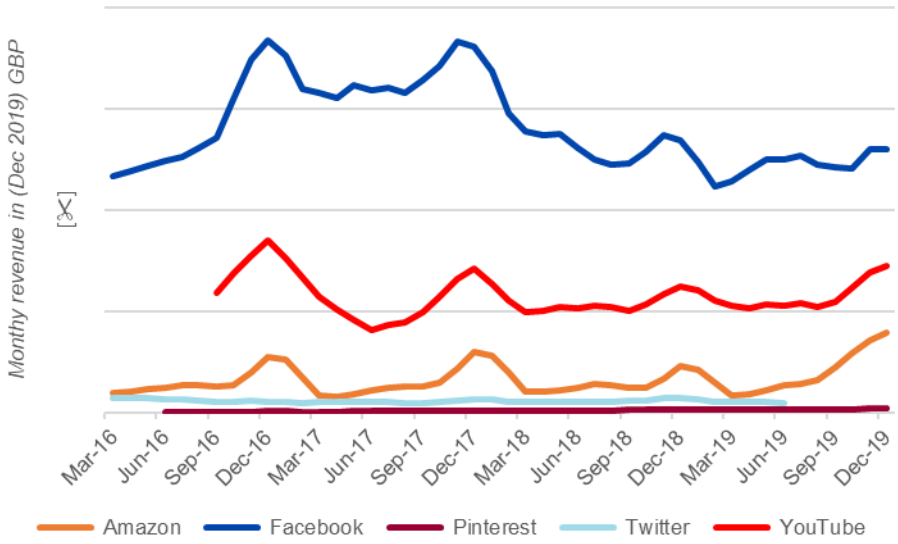
[74] As Pinterest and YouTube did not provide annual data on revenue, we have aggregated the monthly data at the year level.
[75] For each platform we show annual revenue for each year for which we have the data needed to compute it. When we do not show revenue for a given platform in a given year, it is not necessarily the case that the platform generated no revenue from the sale of display advertising in that year.

platform in terms of revenue. The other platforms all had much smaller revenues than Facebook, Instagram and YouTube.

196. All the platforms enjoyed high average annual compound growth rates. Instagram has grown at an average rate of [200-250]% from 2014 to 2019. Facebook has grown at an average of around [40-50]% per year from 2011 to 2019. Pinterest, Amazon, LinkedIn and Snapchat have all grown at annual compound rates between 30% and 105%. The lowest average annual compound growth rate was achieved by YouTube, which has grown at around [10-20]% in the last two calendar years.[76]

197. Figures C.47 and C.48 show monthly display adverting revenues from January 2016 to December 2019 for selected platforms on desktop and mobile respectively. Instagram, Snapchat and TikTok did not serve ads (or only served a negligible number) on desktop devices or did not make their platform available on desktop devices and are therefore not included in Figure C.47 below.

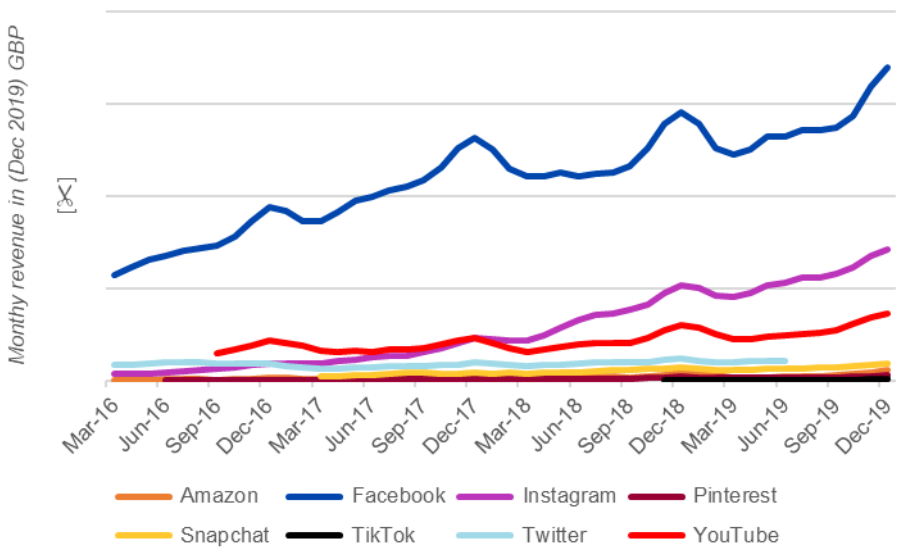
Figure C.47: Monthly UK owned and operated desktop display advertising gross revenue for selected platforms (January 2016-December 2019)



Source: CMA analysis based on parties' data.
Note: Three-month moving average shown in the chart for confidentiality reasons.

[76] We have not computed annual growth rates for TikTok, as it started selling digital advertising in the UK in July 2018.

Figure C.48: Monthly UK owned and operated mobile display advertising gross revenue for selected platforms (January 2016-December 2019)



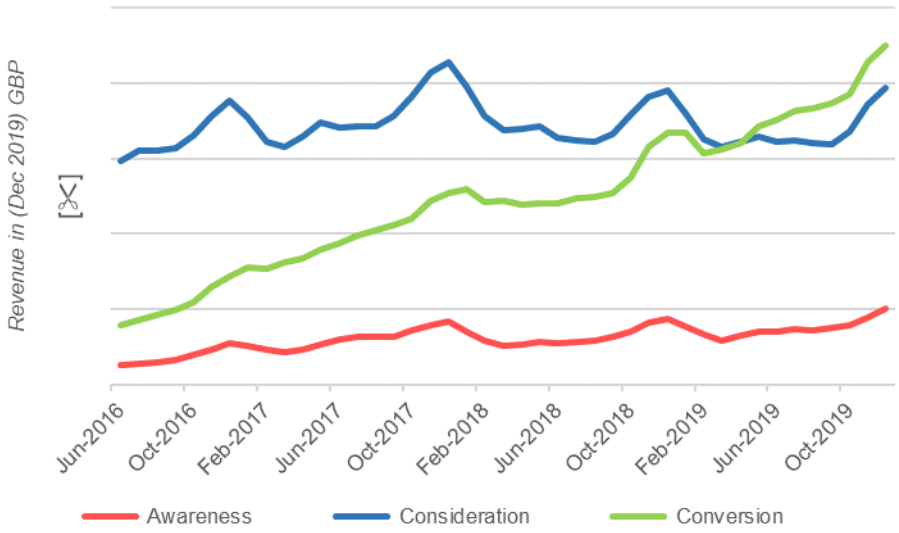
Source: CMA analysis based on parties' data.
Note: Three-month moving average shown in the chart for confidentiality reasons.

198. Facebook (including Instagram for mobile) captured the largest share of revenue in both mobile and desktop, followed by YouTube. For both these platforms revenue growth on mobile has driven overall growth over the period, since revenue from mobile was substantially higher than revenue from desktop. Facebook's revenue on mobile accounted for around [80-90]% of its aggregate revenue in January 2016 and increased to around [90-100]% in December 2019.

199. We have also examined Facebook's revenue breakdown by broad advertiser objectives (ie awareness, consideration and conversion). Figure C.49 illustrates our results.[77]

[77] When planning their campaigns, advertisers first select one of the three following broad objectives: awareness, consideration and conversions. They can then select more granular objectives. Awareness includes the following objectives: Ad Recall Lift, Brand Awareness, Impressions, Reach, Social Impressions. Consideration includes the following objectives: App Installs, Clicks, Event Responses, Landing Page Views, Lead Generation, Mrc video views, Offer Claims, Offsite Clicks, Page Engagement, Page Likes, Post Engagement, Replies, Return On Ad Spend, Engaged Users, External, Engaged Reach, Video Views, Video Views 15S. Conversion includes the following objectives: Offline conversions, Offsite Conversions, Store Visits, Onsite Conversions, Incremental Offsite Conversions.

Figure C.49: Breakdown of Facebook's monthly revenue by advertiser objective (April 2016-December 2019)



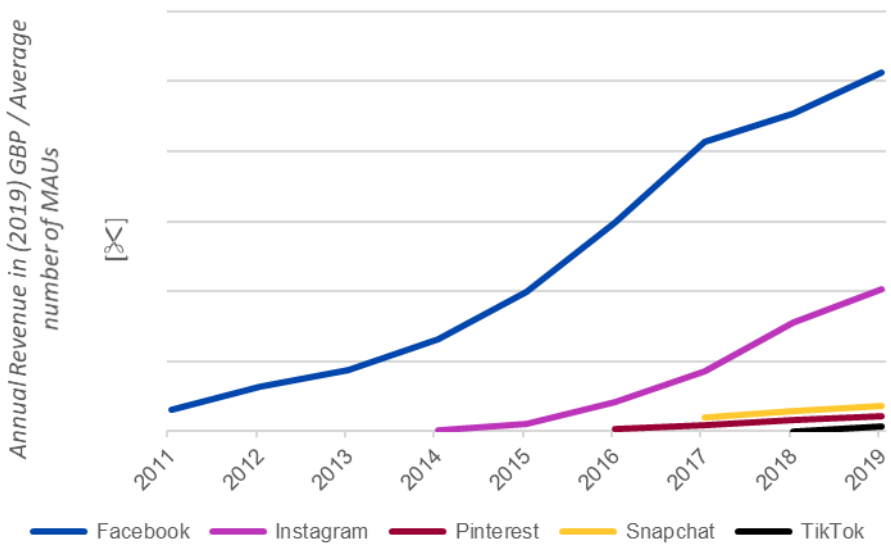
Source: CMA analysis based on Facebook's data.
Note: Three-month moving average shown in the chart for confidentiality reasons.

200. Revenues from awareness-oriented campaigns have historically been lower than revenues derived from the other objectives, covering [5-10]% of total revenue. Consideration-based campaigns' revenue has instead been relatively stable over the period, [✂]. The share of total revenue derived from consideration-based objectives, however, has decreased gradually from [70-80]% in April 2016 to [30-40]% in December 2019. This is explained by the growth in revenue derived from conversion-oriented campaigns, which grew from £[10-20] million in April 2016 to £[80-90] million in December 2019.

201. As explained in the introduction to this subsection, platforms' revenues depend on their ability to monetise the time users spend on their properties. We examine ad load in the next subsection on impression-related metrics. When analysing revenues, however, one way to (partially) abstract from user-side considerations is to look at revenue per user and revenue per time unit. These are shown in Figure C.50 and C.51 below.[78, 79]

[78] Since LinkedIn and Twitter attributed revenue to the UK on the basis of (believed) advertiser location, while by definition average number of MAUs and user time spent are recorded on the basis of user location, we have not presented revenue per user, revenue per hour and ad load for these two platforms.
[79] We use the same estimates as in the Consumer Outcomes section above for user time in this section. The same limitations apply.

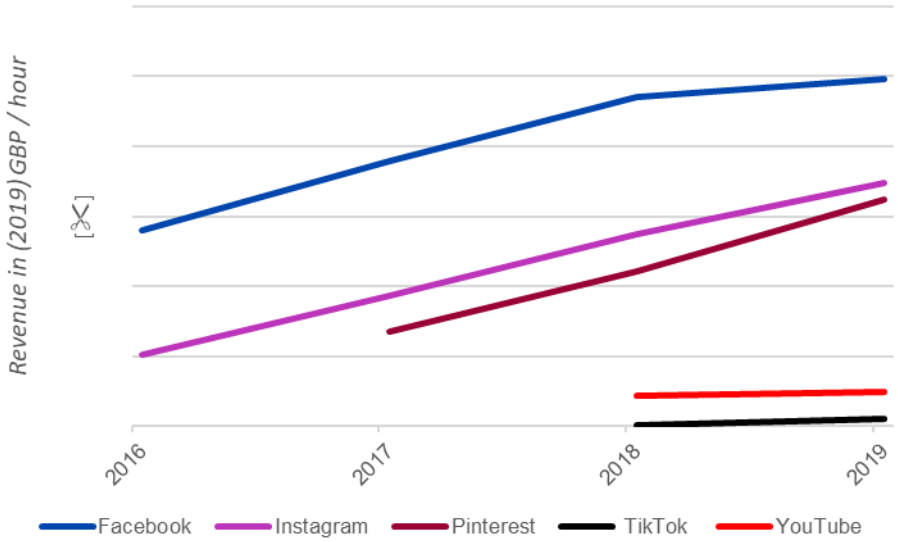
Figure C.50: Average annual gross revenue per user for selected platforms (2011-2019)



Source: CMA analysis based on parties' data.
Note: Users have been accounted by monthly average users (MAU).

202. Facebook had the highest average annual revenue per user in each of the years considered, growing from around £[0-5] in an early growth stage in 2011 to £[50-60] in 2019. Instagram's annual revenue per user grew since the introduction of ads in the UK from £[0-5] in 2011 to £[20-30] in 2019. Facebook's annual revenue per user is more than ten times higher than those competitors for which we have been able to obtain robust UK data [80] The average revenues per user for Pinterest, Snapchat and TikTok in 2019 were below £[0-5].

Figure C.51: Average gross revenue per user hour for selected platforms (2016-2019)



[80] As noted above, we have not presented revenue per user hour for LinkedIn and Twitter as their revenues were attributed to the UK on the basis of (believed) advertiser location, while user numbers are recorded on the basis of user location.

Source: CMA analysis based on parties' data.

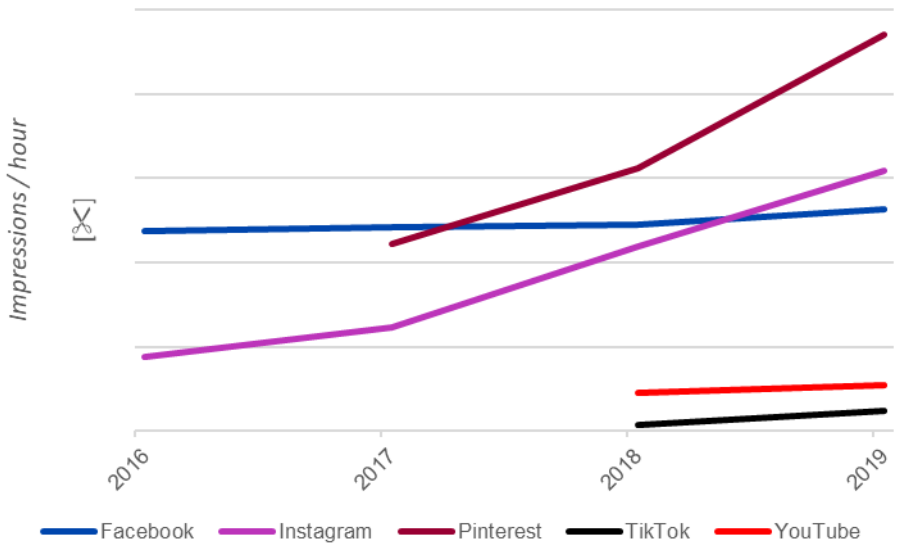
203. Facebook's revenue per hour has almost doubled from 2016 to 2019 (from £[0.1-0.2] to £[0.2-0.3]). Instagram's revenue per hour has experienced even higher growth rates, increasing from around £[0.01-0.1] to £[0.1-0.2] in five years since the introduction of ads in the UK in 2014. Pinterest's revenue per hour has grown at a similar rate to that of Instagram. The other platforms generated lower revenue per user hour spent, with YouTube's being only around £[✂] in both 2018 and 2019.

- *Impression-related metrics*

204. As explained in the introduction to this subsection, the two basic determinants of a platforms' advertising revenue are the number of monetised impressions and the average price charged for such impressions. Taking the time users spend on a platform as given, the total number of monetised impressions depends on the average number of monetised impressions per time unit. This is in turn determined by the average number of impressions shown per time unit and by how successful the platform is at monetising these impressions.

205. In Figure C.52 below, we show average ad load, defined as the average number of impressions shown per hour spent by users on the platform ('user hour').

Figure C.52: Average number of shown advertising impressions per user hour on selected platforms (2016-2019)



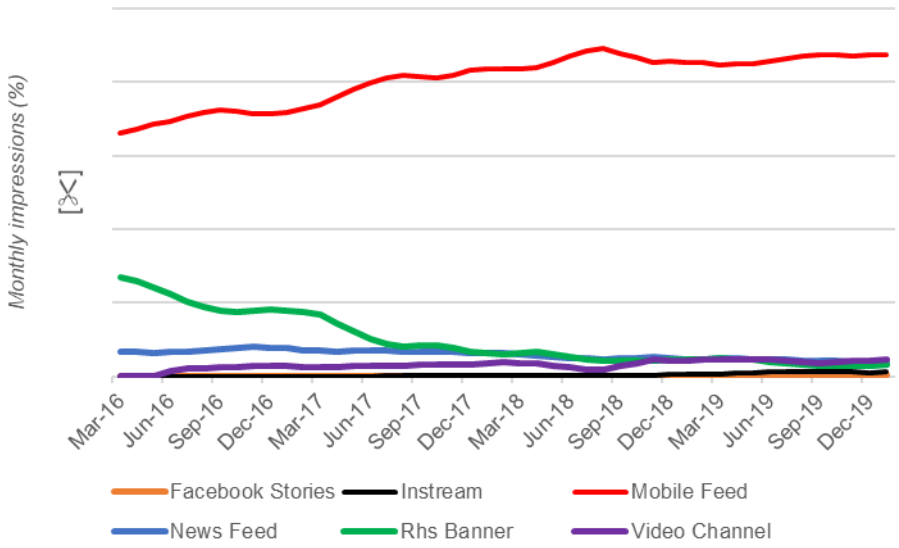
Source: CMA analysis based on parties' data.

206. Pinterest showed an average of around [40-50] impressions per hour in 2017, increasing to [90-100] in 2019 and thus becoming the platform with the highest ad load. In 2019, Instagram had the second-highest ad load, with

around [60-70] impressions per hour: an increase [above 200%] with respect to 2016. Ad load on Facebook has marginally increased from [40-50] ads per hour in 2016 to [50-60] in 2019. The remaining platforms all had lower ad loads, with users on YouTube seeing an average of [0-10] ads for every hour spent on the platform in 2018 and 2019.

207. The ad load figures above potentially hide important composition effects. We have been able to analyse the change in the number of ads by different ad formats on Facebook (shown in Figure C.53). Facebook shows Mobile Feed and Facebook Stories ads on mobile devices only, while News Feed and Right-Hand Side Banner ads (RHS) are shown to users using the desktop version only. Instream and Video Channel can instead be seen on both mobile and desktop devices.[81]

Figure C.53: Percentage breakdown of number of impressions shown on Facebook by ad format (January 2016-December 2019)



Source: CMA analysis based on Facebook's data.
Note: Three-month moving average shown in the chart for confidentiality reasons.

208. Focusing on formats shown on desktop devices, Figure C.53 suggests that Facebook has significantly reduced the number of RHS Banner ads in favour of News Feed ads, with the ratio of the number of News Feed ads to the number of RHS Banner ads increasing from [20-30]% in January 2016 to [110-120]% in December 2019. The vast majority of impressions shown on mobile devices were Mobile Feed ads. The increase in the percentage of such ads as a proportion of all ads shown can be explained by the increasingly important role of mobile devices over desktop devices.

[81] Facebook has not been able to split the number of Instream and Video Channel ads shown between mobile and desktop. We are therefore unable to show estimates split by device type.

- *Price-related metrics*

  - *Methodology*

209. Platforms can employ a variety of pricing models. Here we focus on two of the most important pricing models: cost-per-thousand impressions (CPM) and cost per click (CPC). The former applies when an advertiser agrees to pay the platform when its impression is shown, regardless of the actions then taken by the user to which the impression is shown. The CPC pricing model applies when an advertiser agrees to pay the platform if the user clicks on the ad. As a measure of price, CPC expresses the price of an ad click. For Facebook, we also discuss the cost-per-action (CPA) pricing model, on the basis of which an advertiser agrees to pay the platform conditional on the user taking a preestablished action after seeing the ad (eg add products to the shopping basket on the advertiser's website or sign up to a newsletter).

210. Most platforms allow advertisers to express their bids and pay for advertising on the basis of different pricing models. For example, Facebook enables advertisers to place their bids on a CPC or a CPA basis. It then converts all bids to a CPM basis and only charges advertisers according to this pricing model.

211. It is possible to compute the so-called 'ex-post CPM' and 'ex-post CPC'. At the platform level, the former can be computed by dividing the platform's revenue in a given period by the total number of impressions shown in the period (and multiplying by 1,000), regardless of the pricing model used to charge advertisers or to place bids. This reflects the average price advertisers paid to show 1,000 impressions on the platform. The latter can be computed by dividing the platform's revenue in a given period by the total number of ad clicks in the period, regardless of how many clicks actually triggered payment from advertisers under a CPC pricing model. This corresponds to the average price of an ad click that advertisers paid.

212. For our analysis, we have computed ex-post CPMs. This allows us to use a larger number of observations to compare prices over time within and across platforms on a homogenous basis. Throughout the rest of this section we refer to ex-post CPM simply as 'CPM'.

213. We have been unable to compute ex-post CPCs for all platforms. In practice, it is often difficult to calculate ex-post CPC due to the fact that most platforms do not robustly track the number of ad clicks when CPC is not the applied pricing model. We have computed ex-post CPC for Facebook and Instagram only, as Facebook is the only party that provided a robust measure of number of ad clicks for all impressions. This means that we have been unable to

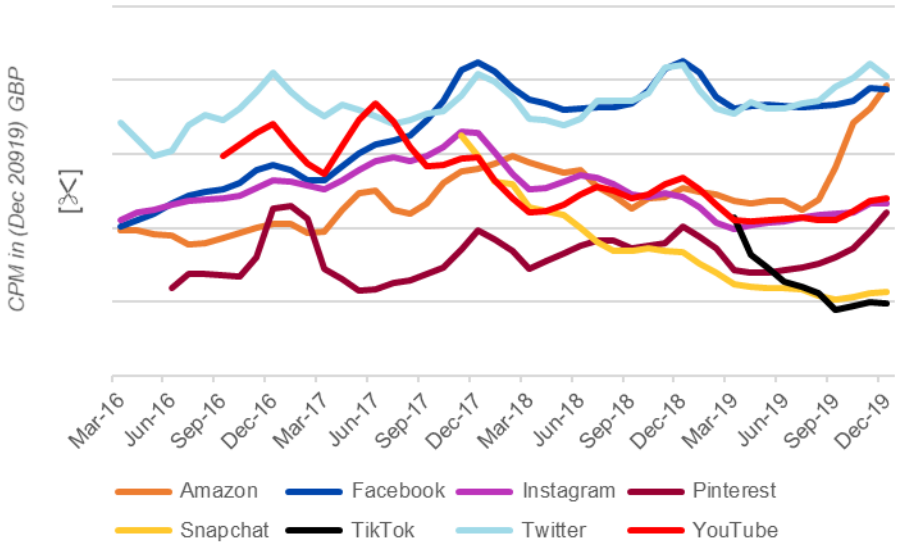
compare on a like-for-like basis the CPC charged by different platforms and therefore have not done such comparison. We present and discuss the analysis of Facebook's (including Instagram's) CPC below. Throughout the rest of this section we refer to ex-post CPC simply as 'CPC'.

214. We have used the monthly data to compute CPMs and CPCs. This has the advantage of allowing us to capture seasonality in prices, as well as to produce our price metrics broken down into a number of splits not available in the annual data.[82]

- *Outcomes*

215. In Figure C.54 we present average monthly CPM for selected platforms from January 2016 to December 2019.[83]

Figure C.54: Average monthly CPM for selected platforms (January 2016-December 2019)



Source: CMA analysis based on parties' data.
Note: Three-month moving average shown in the chart for confidentiality reasons.

216. Facebook and Twitter had the highest CPM throughout most of the period. Facebook's CPM had grown from £[✂] between January 2016 and November 2017 and remained between £[✂] and £[✂] for the rest of the period. Instagram's CPM started roughly at the same level as Facebook's in January 2016 and peaked at £[✂] in November 2017. YouTube's CPM has been

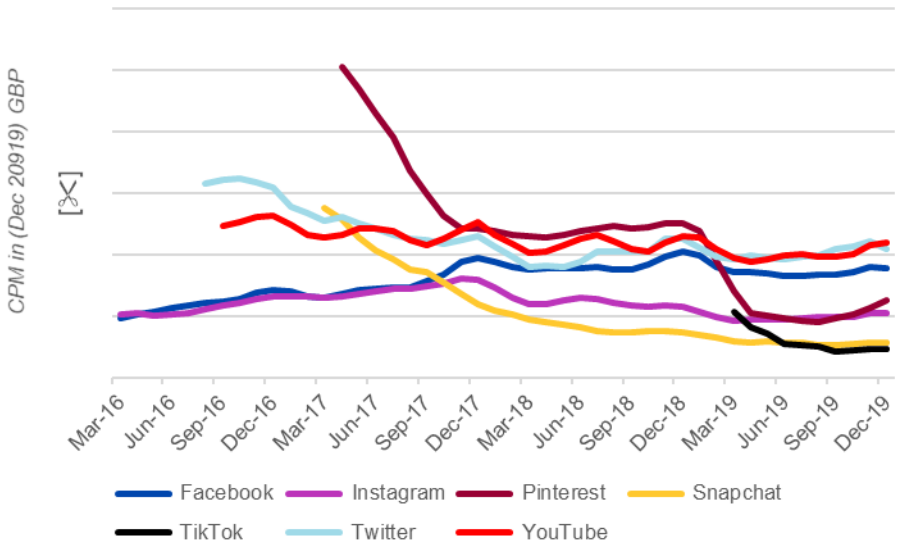
[82] We note that some of the parties attributed data to the UK on the basis of advertiser location. We do not consider this to be an issue when evaluating the evolution of CPMs and CPCs within platforms, as revenue, number of impressions and number of clicks are attributed to the relevant geography according to the same criterion at the individual platform level. However, this poses potential issues in terms of comparability across different platforms.
[83] We do not show Snapchat's CPM before September 2017 as [✂].

generally decreasing over time, although characterised by strong seasonality in the first half of the period.

217. We have examined CPM split by device type to uncover potential composition effects. Our analysis reveals that CPM tended to be higher on mobile than on desktop, yet for both Facebook and YouTube this trend seems to be disappearing in the most recent periods. Facebook was among the platforms with the highest CPM for both mobile and desktop, at least in second half of the period considered.

218. We have also computed CPM separately for video and non-video impressions. Figures C.55 and C.56 display our results.[84]

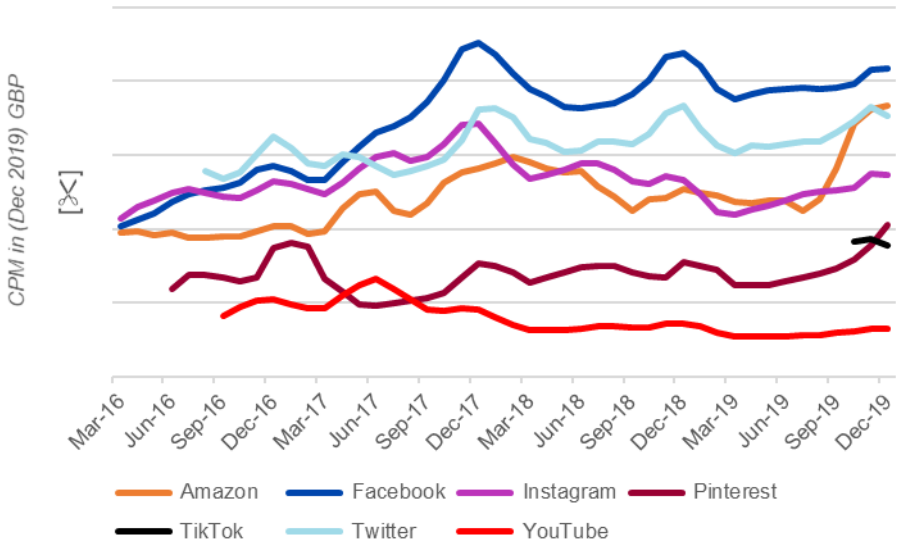
Figure C.55: Average monthly CPM for video impressions for selected platforms (January 2016-December 2019)



Source: CMA analysis based on parties' data.
Note: Three-month moving average shown in the chart for confidentiality reasons.

[84] We have excluded Amazon from the chart for video and Snapchat from the chart for non-video due to the particularly low volumes of impressions of these creative types they showed respectively in the period considered.

Figure C.56: Average monthly CPM for non-video impressions for selected platforms (January 2016-December 2019)

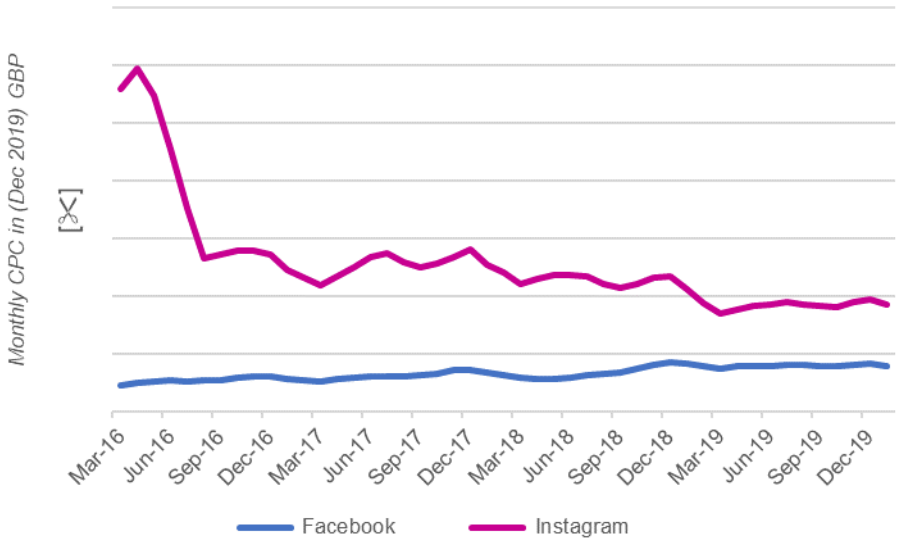


Source: CMA analysis based on parties' data.
Note: Three-month moving average shown in the chart for confidentiality reasons.

219. On some platforms, prices for video impressions tended to be higher than for non-video impressions. This is particularly clear for YouTube, with CPM for video ads being around seven times the CPM for non-video ads. However, Facebook's and Instagram's CPM does not show appreciable differences across the two creative types, thus presenting the same pattern as aggregate CPM.

220. We have carried out the same analysis for CPC on Facebook and Instagram. Figure C.57 displays our results.

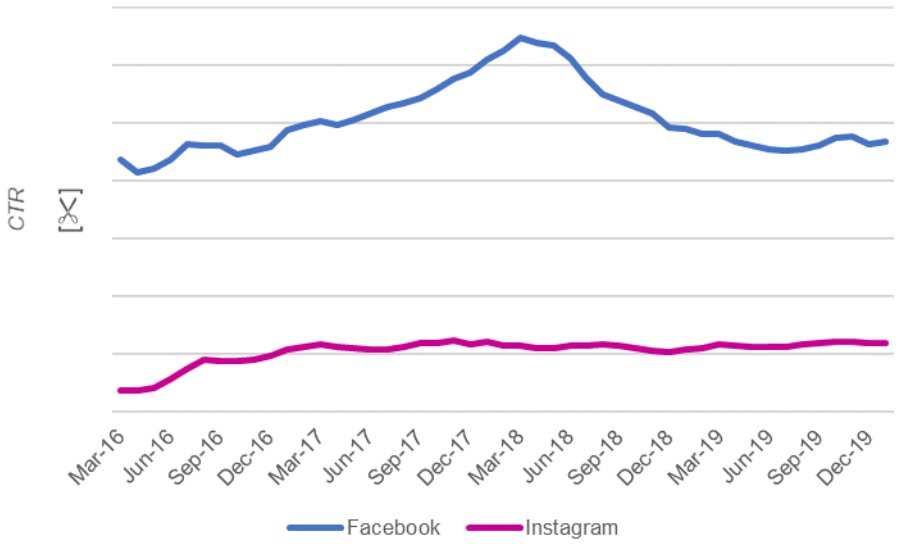
Figure C.57: Average monthly CPC on Facebook and Instagram (January 2016-December 2019)



Source: CMA analysis based on Facebook's data.
Note: Three-month moving average shown in the chart for confidentiality reasons.

221. Facebook's CPC has more than doubled in four years, moving from £[✂] in January 2016 to £[✂] in December 2019. Instagram's CPC was consistently higher than Facebook's throughout the whole period. After a steady decrease at the beginning of 2016, when it peaked at £[✂], it started to decrease gradually, moving from £[✂] in June 2016 to £[✂] in December 2019, even though such an overall trend was characterised by strong seasonality.

Figure C.58: Average monthly CTR on Facebook and Instagram (January 2016-December 2019)



Source: CMA analysis based on Facebook's data.
Note: Three-month moving average shown in the chart for confidentiality reasons.

222. One factor that might explain the difference in observed CPC across Facebook and Instagram is the difference in their ability to attract clicks. To

investigate this, we have analysed click-through rate (CTR). As shown by Figure C.58 above, on Facebook the proportion of ads that received clicks was above [1.5-2.5]%, compared with CTRs of less than [0.5-1.5]% for Instagram.

223. When looking at CPC by device type, we note that for Facebook CPC for ads served on mobile devices was substantially lower (between £[✂] and £[✂]) than for ads served on desktop devices (between £[✂] and £[✂]), although both generally increasing over time. Indeed, CTR for impressions shown on mobile devices proved to be higher (between [✂]% and [✂]%) with respect to CTR for impressions shown on desktop devices (between [✂]% and [✂]%).

224. For both Facebook and Instagram, CPC tended to be higher for video impressions starting from the last quarter of 2017, while CTR generally tended to be higher for non-video impressions.

- *Facebook pricing analysis by advertiser objective*

225. Facebook submitted that CPM is not an appropriate measure of price as it does not provide advertisers with any insights into the likelihood that their ads will lead to profit-generating actions by users, which is what advertisers ultimately care about. It said that, given that it is not always possible to measure the impacts of ads on user actions, advertisers use proxies to measure the return on their (advertising) investments (ROI). It argues that CPA is a better proxy for measuring ROI than CPM, as this measures the cost advertisers incur in order for users to take profit generating actions.

226. Facebook submitted that CPA and CPM can move in opposite directions.[85] For example, if a platform becomes more successful at driving users to take sales-generating actions (eg as a consequence of better targeting), all else being equal, CPA will decrease. This happens because it will take a lower number of impressions to generate the same number of actions. In turn, this has a positive impact on advertisers' ROI, thus increasing demand for impressions on the platform. As a consequence, if supply is unchanged, this will increase auction thickness and eventually CPM. The resulting increase in CPM will in turn lead to a decrease in CPA. Yet, if the former effect prevails, the final result will still be an increase in CPM and a decrease in CPA.

[85] For a given action, ex-post CPA and ex-post CPM are linked by the following relationship: CPM = CPA · (probability of a user taking the action conditional on the user seeing the impression).

Alternatively, CPM might increase, while CPA remains constant if the second effect is strong enough.

227. Facebook holds that it has substantially improved the quality of its offering over time, hence contributing to an increase in demand for its advertising.[86] It argues that, controlling for differences in advertising objectives, CPAs generally remained flat between 2016 and 2019 as a consequence of the mechanism explained in the previous paragraph.

228. When planning their campaigns, advertisers first select one of the three following broad objectives: awareness, consideration and conversions. They can then select more granular objectives (eg app installs, site visits or campaign reach). Facebook tracks user actions corresponding to the objective set by the advertiser, which can be used to compute CPA. For example, if an advertiser sets app installs as an objective, CPA will represent the average cost the advertiser incurs in for a user installing its app.

229. We agree that where advertisers are seeking to generate specific user actions, CPA is a relevant measure of price from the advertiser perspective. We also note that, as shown in Figure C.49 above, Facebook is increasingly being used by advertisers to target conversions. However, Facebook appears to be an outlier in this respect; advertisers told us that they generally use display advertising for more general brand awareness (see Appendix N). Where advertisers have broader objectives, CPM continues to be a more appropriate measure of price. Overall, we consider that there is merit in considering each of the different pricing measures in combination, and that CPM remains informative, as well as being the basis on which most display advertising is sold.

230. We have computed average monthly (ex-post) CPA for each action-based objective by dividing the revenue generated from campaigns with that objective by the number of user actions corresponding to the objective.[87, 88]

231. We show our results for the three most important objectives in terms of number of impressions shown, together accounting from more than half of the

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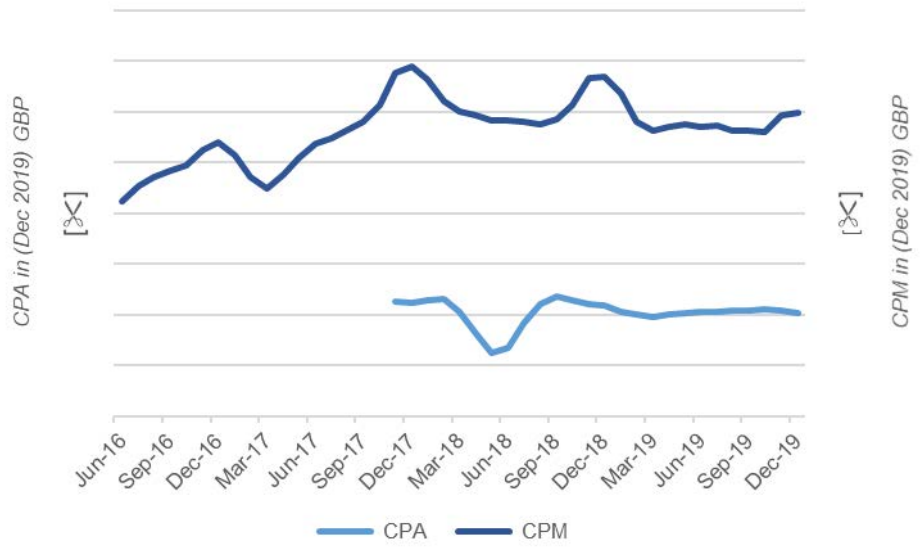
[86] Facebook also provided data showing an increasingly high adoption of its optimization tools from advertisers.
[87] We have identified the following action-based specific objectives: App Installs, Clicks, Event Responses, Landing Page Views, Lead Generation, Offer Claims, Offline Conversions, Offsite Clicks, Offsite Conversions, Page Engagement, Page Likes, Post Engagement, Replies, Return On Ad Spend, Store Visits, and Engaged Users.
[88] We have done so using the monthly dataset Facebook provided. Facebook provided two different measures of the number of actions. One ('conversions') precisely measures the number of user actions corresponding to the objective set by the advertiser and has been available since August 2017. The other one ('conversions old'), despite being provided for the whole time period requested, fails to robustly report the number of user actions corresponding to the objective, as it does not necessarily capture the exact action targeted (eg it might record clicks even when the advertiser was targeting sign-ups). Hence, we have favoured using the former.

impressions shown on Facebook from 2016 to 2019: Offsite Conversions, Offsite Clicks and Post Engagement.[89, 90]

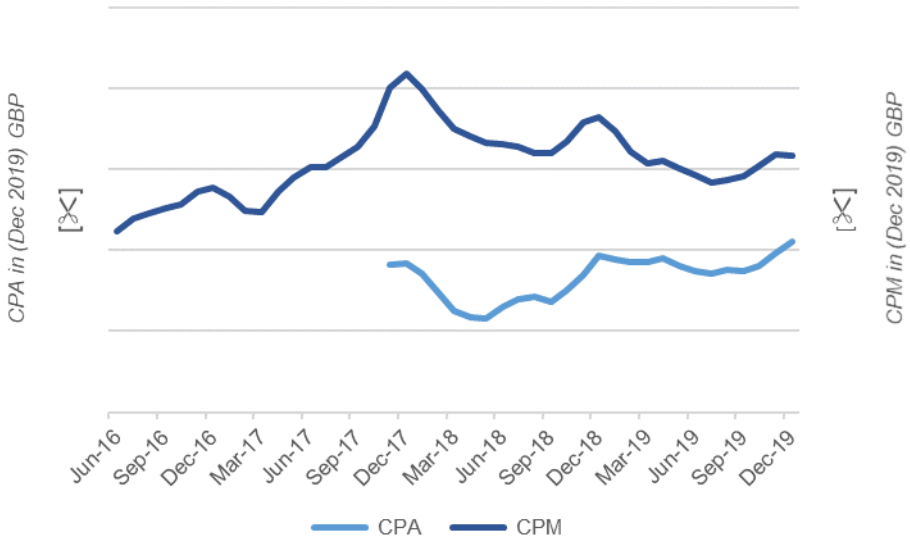
Figure C.59: CPM and CPA for the Offsite Conversions objective on Facebook (April 2016-December 2019)



Source: CMA analysis based on Facebook's data.
Note: Three-month moving average shown in the chart for confidentiality reasons.

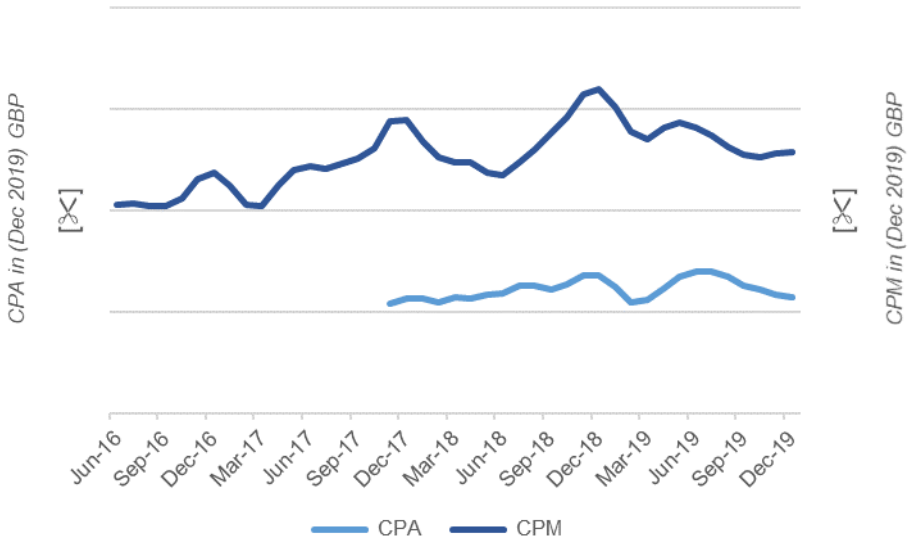
[89] The first captured around [20-30]% of all impressions shown from January 2016 to December 2019 and refers to conversions that happened in-store through advertisers connecting their CRM (customer relationship management) databases or POS (point of sale) systems to their Facebook account. The second captured around [20-30]% of all impressions shown from January 2016 to December 2019 and refers to clicks on a link displayed within a Facebook ad that take the user to the advertiser's website. The last accounted for roughly [10-20]% of all impressions shown between January 2016 and December 2019 and refers to users engaging with the advertiser's page (eg like, share, comment).
[90] We have excluded months for which we have identified CPM and or CPA as outliers. We have defined outliers as values that are greater than 180% or lower than 20% of the yearly average weighted by number of impressions for CPM and number of actions for CPA. We have identified outliers in only one month for each objective. In the charts below, we have represented a linear trend from the month preceding the outlier to the subsequent month for both CPM and CPA.

Figure C.60: CPM and CPA for the Offsite Clicks objective on Facebook (April 2016-December 2019)



Source: CMA analysis based on Facebook's data.
Note: Three-month moving average shown in the chart for confidentiality reasons.

Figure C.61: CPM and CPA for the Post Engagement objective on Facebook (April 2016-December 2019)



Source: CMA analysis based on Facebook's data.
Note: Three-month moving average shown in the chart for confidentiality reasons.

232. Our analysis shows that CPM has generally been increasing over time, even when looking at individual objectives separately. As for CPA, the picture is more mixed, with CPA remaining roughly flat for Post Engagement, overall

decreasing (by [10-20]%) for Offsite Conversion campaigns and increasing by [30-40]% from August 2017 to December 2019 for Offsite Clicks campaigns.[91]

Open display advertising outcomes

233. This section examines outcomes in the open display advertising market based on market data collected from most of the largest advertising intermediaries supplying the UK market, including the Google adtech stack.

234. For the purpose of this analysis, open display advertising includes all digital display ads (including video, banner and native formats) that are purchased and sold via a digital advertising intermediary[92] which is not the publisher itself (therefore, this does not include digital display advertising that is purchased from publishers who own the inventory, such as Facebook, via an online portal or interface – the 'owned and operated' channel). Also included is all other UK display advertising which is not sold through the owned and operated channel. Most notably, this will include so-called 'direct deals', which are generally purchased and sold via semi-automated and manual processes such as insertion orders, directly from the publisher. The sections below outline our analysis of the following features of open display advertising in the UK:

- the size of open display advertising in the UK;
- shares of supply of publisher ad servers;
- shares of supply of the major supply side platforms (SSPs) and ad networks supplying the UK market;
- shares of supply of the major demand side platforms (DSPs) supplying the UK market;
- shares of supply of advertiser ad servers; and
- monthly analysis of some key market parameters for open display advertising over the past two years.

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[91] Facebook carried out the same analysis on the basis of the same data and we have come to the same results. However, Facebook's conclusion differs in that they argue that there hasn't been any material change in CPA over time. Facebook also submitted their internal analysis of CPA that they argue shows that CPA has stayed roughly flat. We note that this analysis does not look at the UK separately, but at changes in CPA prices in Western Europe.

[92] Such as a DSP or ad network; for these purposes we do not count media agencies as a digital advertising intermediary.

The size of open display advertising in the UK

235. We estimated the value of media spend by advertisers through the open display channel using a 'top-down' method that uses data from Google's publisher ad servers – Google Ad Manager (in its capacity as an ad server), Google AdSense and Google AdMob – as the basis of the estimate.

236. The publisher ad server is the tool that places digital display advertising on a content publisher's website or app. All display advertising is placed on a website or app by an ad server. Our analysis, set out below, shows that Google's share of publisher ad serving in the UK is very high. Therefore, the vast majority of display advertising served to UK users will be served by Google. We therefore consider that data from Google's ad servers is a reasonable starting point for an estimate of the size of open display advertising spending in the UK.

237. From our discussions with Google we understand that the total number of display ads that are served by Google to third-party websites or apps is the sum of ads served to third parties via Google Ad Manager, Google AdSense and Google AdMob. Google has provided us with data on the number and value of ads served by Google Ad Manager, Google AdSense and Google AdMob to UK IP addresses. We have used this data along with data from other publisher as servers to estimate the total value of open display advertising in the UK. We explain in more detail how we have constructed such estimate below.

238. The data can be broken down into two main categories:

- 'Google programmatic' – ads that have been through Google's programmatic auctions such as AdX/Authorised Buyers and Open Bidding; and

- 'non-Google programmatic' – ads that have arrived at Google ad servers from other routes, including via header bidding or directly from third-party ad networks or SSPs, and 'direct reservations', ie deals arranged directly between advertisers and content publishers.

239. The total value of display ads served to third-party websites by Google is the sum of the total value of ads in these two categories. However, Google is able to observe the price only of 'Google programmatic' ads. Google is, however, able to observe the number of 'non-Google programmatic' ads. We can therefore directly estimate the value of Google Programmatic ads from the Google ad server data but not the value of non-Google programmatic ads. In order to estimate the total value of the non-Google programmatic ads, we proceeded as follows:

- We first made an assumption about their average price. We have assumed the average CPM of non-Google ads is £2. To reach this estimate, we have looked at the data on ad values we received from non-Google DSPs. We have analysed data from the major DSPs and, whilst there is considerable variation in the average CPM across them, the weighted average CPM was approximately £2 in real terms for both 2018 and 2019.[93] While this CPM estimate includes all fee and charges by DSPs, it does not other buy-side fees charged by intermediaries such as media agencies, data providers and ad verifications service providers.

- We then multiplied this assumed average CPM of non-Google programmatic ads by number of non-Google programmatic ads in the Google Ad server data to generate an initial estimated value for non-Google programmatic Ads.

- Finally, we made an upwards adjustment to this value to account for the fact the assumed CPM does not include other buy-side fees charged by intermediaries such as media agencies, data providers and ad verification service providers. Based on our analysis of adtech fees, set out in Appendix R, we have assumed this to be 5% of total advertising spend.

240. We have also made an upwards adjustment to the value of programmatic ads reported by Google to reflect the fact that these ads will have incurred fees by other intermediaries before entering the Google programmatic auctions. As Google explains, the reported ad values are 'the value the publisher would realise if it had a 100% revenue share in Google's programmatic auction. Demand-side and supply-side fees (that is, what the CMA is referring to as gross commissions) are not included in this value whether the ads passed through the Google ecosystem or not'. We have therefore made an upward adjustment to the ad values to reflect typical charges made by demand and supply-side intermediaries likely to have been deducted from the ad value before it reaches the Google ecosystem:

- For expenditure related to ads sold through the Ad Manager (AdX/Authorised Buyers) auctions, we have assumed that they will have incurred a DSP fee and other buy-side fees (such as fees from media agencies, data providers and ad verifications service providers) prior to entering the Google ecosystem. Based on our analysis of adtech fees,

[93] Our analysis of the data from non-Google DSPs suggests and average CPM of £1.99 for 2019 and £1.96 for 2018. These are likely to be underestimates of the value of ads in the 'other' category as many of the ads in this category are direct deals, which do not pass through a DSP, and which typically are relatively high value ads.

set out in Appendix R, we have assumed this to be 20% of total advertising spend.[94]

- For expenditure related to ads sold though Ad Sense and AdMob, we have assumed they incur other buy-side fees (such as fees from media agencies, data providers and ad verifications service providers), but not DSP fees,[95] prior to entering the Google ecosystem. Based on our analysis of adtech fees set out in Appendix R, we have assumed this to be 5% of total advertising spend.[96]

- For expenditure related to ads sold through Open Bidding we have assumed that they have incurred both buy and sell-side fees before entering the Google ecosystem. Based on our analysis of adtech fees, set out in Appendix R, we have assumed this to be 35% of total advertising spend.[97]

241. As set out below in our discussion of shares of supply for publisher ad servers, Google-served ads do not account for all open display ads served to UK users, as some open display ads are served by other ad servers and ad networks. The vast majority of these ads are served by FreeWheel and Taboola. We have therefore made a separate estimate for the value of ads served by FreeWheel and Taboola, estimated as the number of ads they served multiplied by the average CPM of ads sold on these networks.[98]

Table C.8: Estimated value of display advertising spend on ads served by Google (2018-2019)

		Value of ad spend (£m)	
		2019	*2018*
Total ads served by Ad Manager	From Google AdX programmatic auctions	[✂]	[✂]
	From Exchange Bidding	[✂]	[✂]
	From non-Google programmatic auctions	[✂]	[✂]
Total ads served via AdSense		[✂]	[✂]
Total ads Served by AdMob		[✂]	[✂]
Total ads served Google		[1500-2000]	[1500-2000]
Total ads served by non-Google (FreeWheel, Taboola)		[150-250]	[150-250]
Total		**[1650-2250]**	**[1650-2250]**

Source: CMA analysis of Google, Taboola and FreeWheel data.

[94] Note this is an approximation based on the analysis of the adtech fees.
[95] Ad Sense and Ad Mob typically operate as an ad network whereby the ads sold through them are usually bought through Google Ads. The vast majority of ads sold through Ad Sense and AdMob will not have passed through an external DSP before entering the Google ecosystem.
[96] Note this is an approximation based on the analysis of the adtech fees.
[97] Note this is an approximation based on the analysis of the adtech fees.
[98] As reported in their SSP data. We have assumed these ads will incur other buy-side fees (such as fees from media agencies, data providers and ad verifications service providers), but not DSP fees. Based on our analysis of adtech fees, set out in Appendix R, we have assumed this to be 5% of total advertising spend.

242. The estimates in Table C.8 show that the value of expenditure on display ads served by Google was [£1.5-2] billion in 2019 (£[1.5-2] billion in 2018). When we also take into account ads served by FreeWheel and Taboola, the estimates for the value open display ad expenditure in the UK was £[1.65-2.25] billion in 2019 (£[1.65-2.25] billion in 2018).[99]

243. This top-down estimate for the value of UK open display advertising is lower than an IAB estimate of £2.26 billion for UK 'non-social' display advertising expenditure in 2018[100] and £2.610 billion in 2019[101] Differences between our estimate and the IAB's could arise for a number of reasons, including the definitions of the market segments,[102] the scope of the coverage of the types of transaction,[103] and methodological differences.[104]

Publisher ad servers share of supply

244. We have collected data from a number of intermediaries who provide publisher ad serving services for open display ads displayed to UK users.[105] These include some specialist publisher ad servers and some ad networks. Our analysis of this data is set out in Table C.9, it shows that:

- Amongst all of the intermediaries who served ads to UK users from whom we received data, Google had a share of [70-80]% of impressions served (Ad Manager [50-60]%, Ad Sense [0-10]% and AdMob [0-10]%).

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[99] This is lower than our preliminary same published in the interim report. This because (1) our assumption for the CPM of 'other' ads served by Google has changed based on new data and further clarifications received from intermediaries; and (2) We now make better informed assumption about what fees have been incurred on ad spend prior to it reaching the ad servers our assumptions about upward adjustment to different categories of expenditure have changed.
[100] 2018 IAB and PWC Digital Adspend Study. Social display includes advertising on platforms such as Facebook, Snapchat, Instagram and YouTube.
[101] 2019 IAB PWC Adspend Study.
[102] Our understanding is that the IAB definition of 'non-social' display advertising closely corresponds to our definition of open displays advertising.
[103] The IAB definition of the UK is perhaps slightly wider than ours, being 'revenue earned by internet media companies in the UK, designed and intended for an audience in the UK', whereas our definition is for ads delivered to UK users.
[104] The IAB bases its estimate on an extensive survey of publishers, media agencies and digital advertising intermediaries; however, it uses modelled revenues for a number of significant market participants, including Google and Facebook. As with the CMA estimate, a number of assumptions will need to be made to turn the raw data into an overall estimate. Our estimate will only capture the value of advertising expenditure passing through one of the major third-party ad servers (Ad manager, Ad Sense, AdMob, FreeWheel and Taboola). One major difference could be that directly sold advertising which does not pass through a third-party ad server would be captured by the IAB study but not by ours. Direct sales account for a large number of open display transactions. Direct sales are commonly managed by publishers through their third-party ad server along with other types of open display advertising. However, it is possible that a proportion of these direct sales do not pass through a third-party ad server and are instead managed using a publisher's internal ad serving tools. We have not been able to ascertain the scale of this.
[105] Google, Verizon Media, FreeWheel, Smart, Outbrain, Taboola and Triplelift. Note that whilst Xandr do provide ad server services and serve ads to users in the UK, they reported having no Publisher Ad Server clients in the UK in 2019. Verizon Media said that they were closing down their ad server services at the end of 2019.

- Amongst specialist publisher ad servers, Google Ad Managers' share of impressions served was [90-100]%.

Table C.9: Publisher ad servers shares of supply (2019)

	Share All (%)	*Share – excl. ad networks (%)*
Google – Ad Manager	[50-60]	[90-100]
Google – AdSense	[0-10]	
Google – AdMob	[0-10]	
Other (FreeWheel, Outbrain, Smart, Taboola, Verizon*, TripleLift)	[20-30]	
Other (FreeWheel, Smart, Verizon*)		[0-10]

*estimated
Source: CMA analysis of publisher ad server data.

SSP shares of supply

245. We have used the data collected from individual publisher-facing intermediaries to calculate some indicative shares of supply. The definition of publisher-facing intermediaries includes both SSPs and ad networks. Below we present share of supply estimates: first across all publisher-facing intermediaries including SSPs and ad networks; and second for SSPs only. We calculated the shares of supply for each individual SSP or ad network as the value of ads sold by each as a percentage of the total value of ads sold by all publisher-facing intermediaries or SSPs as appropriate. The share estimates are indicative as we have not received data from all publisher-facing intermediaries who sell open display advertising in the UK.[106]

246. We set out estimates of SSP shares of supply in Table C.10 below. As we are estimating shares of entities that operate at the same point in the supply chain, we have not made any adjustments to the values of ads sold to reflect fees deducted from advertising expenditure before reaching the SSP or ad network.

[106] We note that there will be a number of SSPs or ad networks, outside of those we have received data from, who supply into the UK. Whilst there are a wide range of publisher facing intermediaries who sell UK advertising inventory, our understanding is that the vast majority of UK display advertising is sold by a fairly small number of intermediaries.

Table C.10: Estimated shares of supply across all publisher-facing intermediaries (2019) [107]

SSP/Ad network	*Market share (as % of the total value of ads sold)*
Google AdX	[20-30]
Google AdMob	[10-20]
FAN	[10-20]
Google AdSense	[5-10]
Xandr	[5-10]
Teads	[5-10]
Taboola	[5-10]
Others (Rubicon Project, Index Exchange, Outbrain, OpenX, Pubmatic, Triplelift, Smart, Freewheel, Verizon Media, Sharethrough)	[10-20]

Source: CMA analysis of SSPs' and ad networks' data.

247. The SSP share of supply estimates set out in Table C.11 show that the Google family of publisher-facing intermediaries have a strong market position. Google accounts for between [50-60]% of the value of ads sold across all of the SSPs and ad networks.[108]

Table C.11: Estimated shares of supply across all SSPs (2019) [109]

SSP	*Market share (as % of the total value of ads sold)*
Google AdX	[50-60]
Xandr	[10-20]
Rubicon Project	[5-10]
Others (Index Exchange, OpenX, Pubmatic, FreeWheel, Smart, Verizon Media)	[10-20]

Source: CMA analysis of SSPs' data.

248. Of the pure SSP intermediaries, Google AdX is by far the largest, with its share of value of ads sold being [50-60]%.[110]

Change in AdX share of impressions served through Ad Manager over time

249. We have analysed ad server data provided to us by Google from its Ad Manager product to examine how Google's AdX's share of supply has evolved over the past three years. The data we received contains monthly data on the total number of ads served by Ad Manager over the past three years. This data can be further broken down into the following categories, based on the source from which the ad arrived at the ad sever:

- Google's programmatic auctions – effectively AdX – ads which were won and were served by Google's Ad Manager can be calculated as the sum

[107] For most of these SSPs, the data relates to ads displayed to is UK users, but a small number of them have used a close proxy (UK customers).
[108] We note these estimates are based on internal figures provided by Google that had not been subject to audit.
[109] For most of these intermediaries, the data relates to ads displayed to is UK users, but a small number of them have used a close proxy (UK customers).
[110] By way of comparison, the Plum Consulting Report 'Online Advertising in the UK' suggested an indicative range of 25% to 35% for Google's share of the 'revenue from online display advertising inventory traded in the open market, excluding video' passing through SSPs.

of the channels 'open auction', 'private auction' and 'programmatic guaranteed deals'.

- Other – ads from sources other than Google's programmatic auction, including ads from reservation line items (such as direct sales) or third-party ad sources (excluding header bidding and change bidding).
- Header bidding – impressions won by bidders though header bidding services.
- Open Bidding (previously Exchange Bidding) – impressions won by bidders on Google's Open Bidding service.

250. In Table C.12 below we present the results of our analysis of the average proportion of ads served annually by Ad Manager from these sources. The analysis shows that:

- 'Other' is the largest source of ads, but the proportion of ads accounted for by this source has been declining year on year – from [60-70]% in 2017 to [40-50]% in 2019.
- The proportion of ads sourced from AdX has been increasing year on year – from [20-30]% in 2017 to [30-40]% in 2019.[111]
- The proportion of Ads sourced from header bidding has been increasing year on year – from [5-10]% in 2017 to [10-20]% in 2019.
- Open Bidding is a responsible for a relatively small proportion of ads arriving at Ad Manager – [0-5]% in 2019.

Table C.12: Shares of impressions delivered through Ad Manager (2019)

Year	*Google AdX*	*Other*	*Header bidding (estimate)**	*Open bidding*
2019	[30-40]%	[40-50]%	[10-20]%	[0-5]%
2018	[20-30]%	[50-60]%	[10-20]%	[0-5]%
2017	[20-30]%	[60-70]%	[5-10]%	[0-5]%

* Google cannot fully verify that an impression is indeed a header bidding impression. As such, the header bidding data in this table should be understood as a rough estimate.
Source: CMA analysis of Google Ad Manager data.

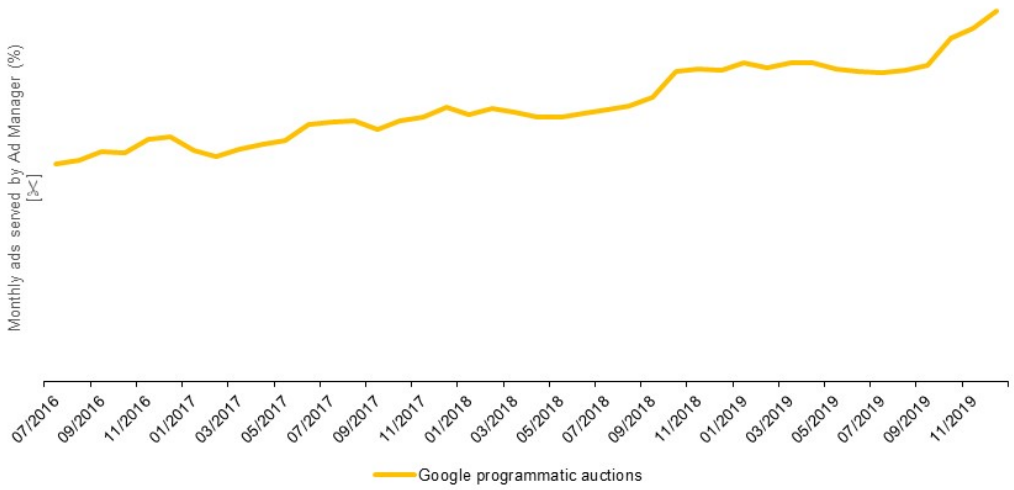
251. In Figure C.62 below we present our analysis of the average proportion of ads served monthly by Ad Manager from these sources since July 2016. The analysis confirms that the portion of ads sourced from Google AdX and header bidding has been increasing at the expense of 'other' ads. This

[111] Note this number is not directly comparable to the AdX share estimates presented in tables C.10 and C.11 as (1) they are based on volumes of impressions rather than the value of ads; and (2) the Ad Manager data will include ads which have not passed through publisher intermediaries such as an ad network or SSP (for example, direct sales).

analysis suggests that the introduction of header bidding has, if anything, taken share from non-Google sources rather than from Google AdX – although we cannot observe the counterfactual situation of what might have happened to the Google AdX share if header bidding had not been introduced.

252. The analysis in Figure C.62 shows an increase in the proportion of ads sourced from Google AdX since July 2016.

Figure C.62: Share of AdX impressions delivered through Ad Manager (2016-2019)



Source: CMA analysis of Google Ad Manager data.

DSP shares of supply

253. We have received data on the value of UK display advertising inventory purchased from all major DSPs who operate in the UK. Our understanding is that these DSPs will account for the vast majority of UK digital display advertising inventory purchased via a DSP.[112] We set out estimates of DSP shares of supply in Table C.13 below. We calculated the shares for each individual DSP as the value of ads purchased by the DSP as a percentage of the total value of ads sold by all DSPs for which we received data.

[112] Whilst there are a wide range of DSPs who purchase UK display advertising inventory, our understanding is that the vast majority of UK display advertising is purchased through a fairly small number of intermediaries.

Table C.13: Estimated shares of supply of DSPs (2019)[113]

DSP	*Market share not including Google Ads (as % of value of ads purchased)*	*Market share including Google Ads (as % of value of ads purchased)*
Google DV360	[40-50]	[30-40]
Google Ads	N/A	[10-20]
The Trade Desk	[10-20]	[5-10]
Xandr	[5-10]	[5-10]
Criteo	[5-10]	[5-10]
Amazon DSP	[5-10]	[0-5]
Others (Quantcast, Verizon Media, Adobe, DataXu, Adform, MediaMath)	[10-20]	[10-20]

Source: CMA analysis of DSPs' data

254. The DSP share of supply estimates show that Google DV360 is the largest player in the market, accounting for [40-50]% of the value of ads purchased by the DSPs from whom we received data.[114] Google Ads is often not described as a DSP as it usually operates effectively as an ad network. However, if we include ads sold through Google Ads in the calculation, then the combined market share of DV360 and Google Ads is [50-60]%.

Advertiser ad servers share of supply

255. We have collected data from a number of intermediaries who provide advertiser ad serving services for open display ads displayed to UK users.[115] Our analysis of this data is set out in Table C.14. It shows that amongst all of the intermediaries who served ads to UK users from whom we received data Google had a share of [80-90]% of impressions served.

Table C.14: Advertiser ad servers shares of supply (2019)

	Share (% impressions served)
Google	[80-90]
Flashtalking	[10-20]
Other (Adfrom, Amazon*, Innovid)	[5-10]
Total	

*Previously Sizmek, Amazon acquired Sizmek in May 2019
Source: CMA analysis of advertiser ad server data.

Time series analysis of key market outcomes in open display advertising

256. In this section we set out our monthly time series analysis of key market outcomes in open display advertising over the two-year period between January 2018 and December 2019. We received market data from 13 DSPs (including Google ads) however, not all were able to provide complete

[113] For most of these DSPs, the data relates to ads displayed to is UK users, but a small number of them have used a close proxy (UK customers).
[114] By way of comparison, the Plum Consulting Report 'Online Advertising in the UK' suggested an indicative range of 30% to 50% for Google's DV360's share of the 'revenue from online display advertising inventory traded in the open market, excluding video' passing through DSPs.
[115] Adform, Amazon (Sizmek), Flashtalking, Google, and Innovid.

monthly data for the full period. The analysis presented below is based on data from a subset of these DSPs, these are (unless otherwise stated): DV360, Google Ads, Xandr, The Trade Desk, Verizon Media, Criteo, Adobe, Adform, DataXu, and Mediamath. For most of these DSPs, the data relates to ads displayed to UK users, but a small number of them have used a close proxy (UK customers). Data covers total values of ads, total impressions sold, click-through rate (CTR), CPC and CPM.

257. The analysis presented below covers all ads purchased by these DSPs. However, the composition of the ads purchased by different DSPs differs along a number of dimensions, so comparisons across DSPs need to be made with caution. These dimensions include:

- Device – mobile vs desktop/laptop;
- Format – video vs non-video; and
- Channel of sale – open market, private auction, or programmatic guaranteed.

Value of ads and number of impressions purchased

258. In Figures C.63 and C.64 below we present analysis of the monthly value of ads purchased and number of impressions purchased by:

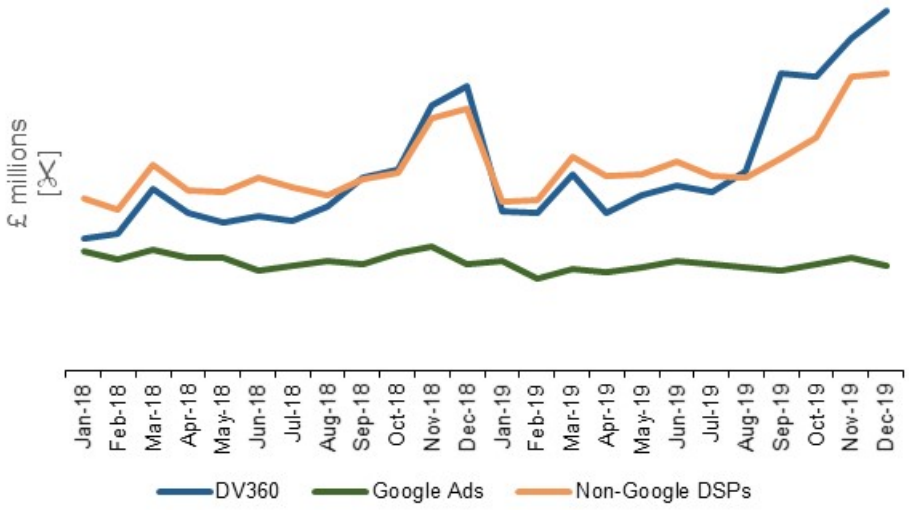
- DV360;
- Google Ads; and
- Non-Google DSPs (data aggregated across Xandr, The Trade Desk, Verizon Media, Criteo, Adobe, Adform, DataXu, and Mediamath).

259. The analysis shows that:

- The value and volume of ads purchased by DV360 is similar over the two-year period to the aggregated figures for all non-Google DSPs.
- DV360 volumes and values have been growing at a faster rate than non-Google DSPs.
  - Value of ads sold by DV360 grew by between [20-30]% year on year (from 2018 to 2019) in real terms and volumes grew by [20-30]%.
  - The aggregated value of ads sold by non-Google DSPs grew by 9% year on year (from 2018 to 2019) in real terms and the volume by 8%.

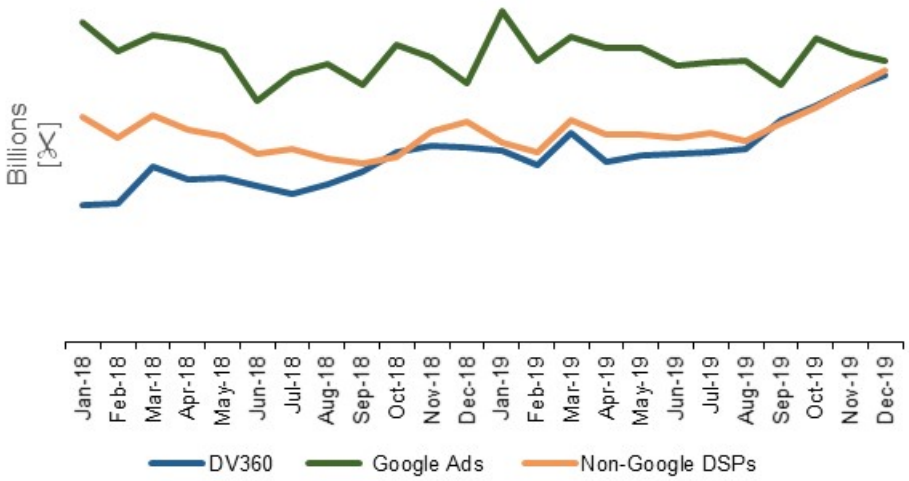
- Higher volumes of impressions were sold through Google Ads than were sold through DV360 or non-Google DSPs, but the value of ads sold by Google Ads was lower than the value of ads sold by either DV360 or by the non-Google DSPs.

Figure C.63: Monthly value of open display ads purchased by DSPs (2018-2019)



Source: CMA analysis of DSPs' data.

Figure C.64: Monthly volume of display ads purchased by DSPs (2018-2019)



Source: CMA analysis of DSPs' data.

CPM, CTR and CPC

260. In Figures C.65 C.66 and C.67 below we present the results of our analysis of the monthly CMPs, CTRs and CPCs for:

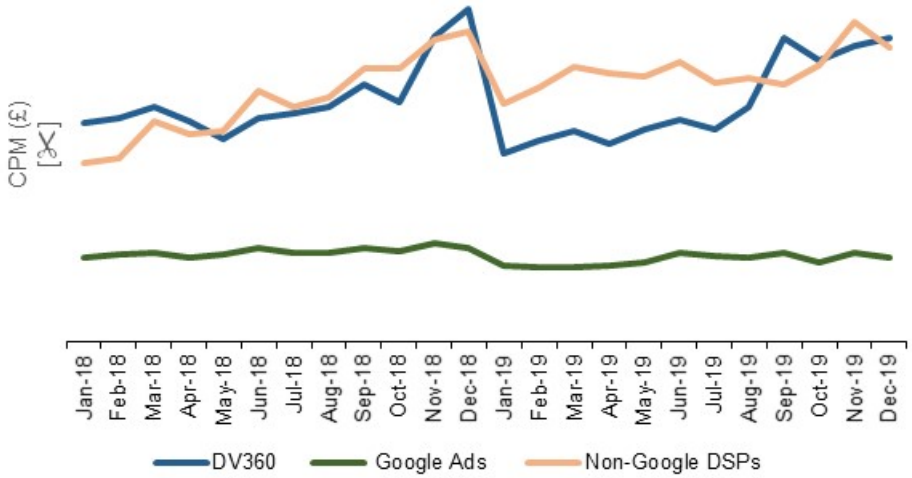
- DV360;

- Google Ads; and
- Non-Google DSPs (data aggregated across Xandr, The Trade Desk, Verizon Media, Adobe, Adform, DataXu, and Mediamath).[116]

261. The analysis shows that:

- Over the two-year period market outcomes in terms of CPM, CTR and CPC achieved by DV360 and the non-Google DSPs were broadly similar.
- Google Ads had a significantly higher CTR than either DV360 or the non-Google DSPs, but lower CPC and CPM. There are a number of differences between Google Ads and other DSPs which may contribute to the contrast in these observed market outcomes for Google Ads when compared with other DSPs: 1) there is a difference in the customer base of Google Ads compared to most other DSPs – Typically, display ads purchased though Google Ads are bought by relatively smaller advertisers; 2) Google Ads customers can purchase ads based on CPC rather than CPM – ads are purchased from most other DSPs based on CPM; and 3) there may be a difference in the type of inventory typically purchased by Google Ads.[117]

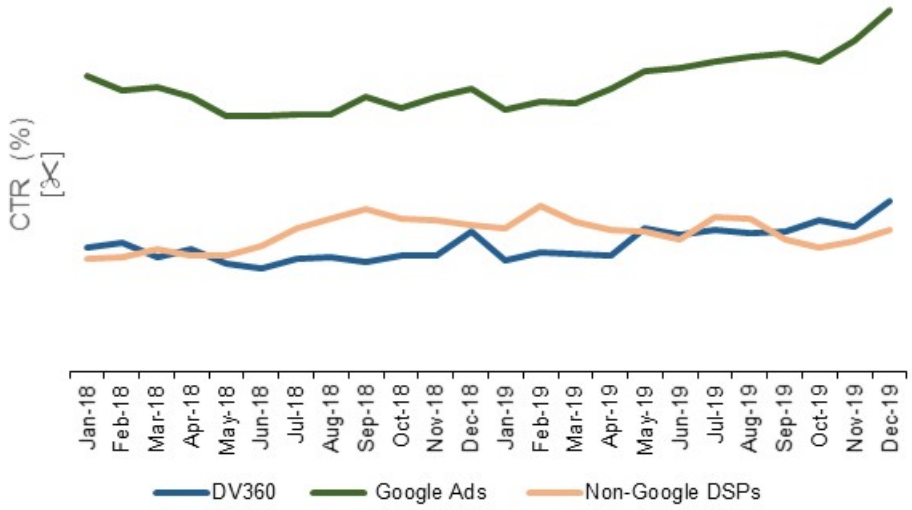
Figure C.65: Monthly average CPM of display ads purchased by DSPs (2018-2019)



Source: CMA analysis of DSPs' data.

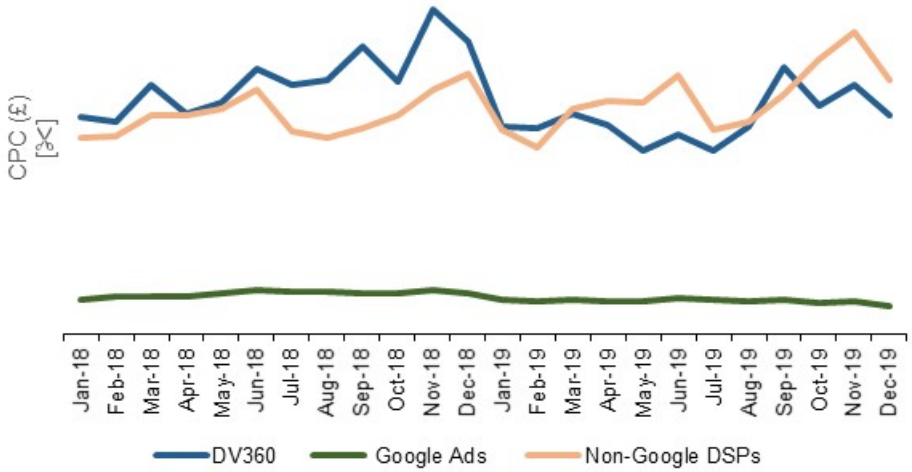
[116] Note we have excluded Criteo from this analysis as it has a very distinct business model based on retargeting, which can lead to materially different values for CPM, CTR and CPC compared with most other DSPs.
[117] Google Ads buys a higher proportion of its Ads through AdMob and AdSense compared with other DSPs.

Figure C.66: Monthly average CTR of display ads purchased by DSPs (2018-2019)



Source: CMA analysis of DSPs' data.

Figure C.67: Monthly average CPC of display ads purchased by DSPs (2018-2019)



Source: CMA analysis of DSPs' data.

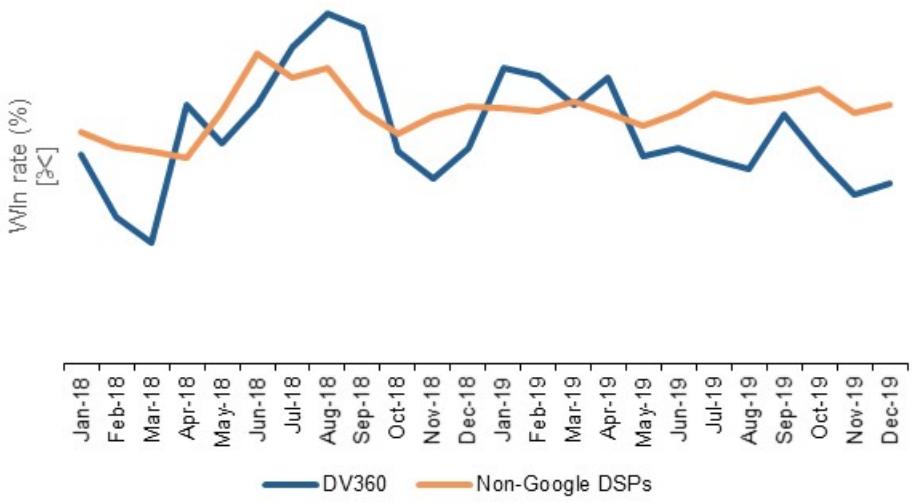
Win rates

262. In Figure C.68 below we present the results of our analysis of the monthly win rates (impression won divided by bids made) for:[118]

- DV360;
- Non-Google DSPs (data aggregated across Criteo, The Trade Desk, Verizon Media, DataXu, and Mediamath).[119]

263. The analysis shows that for most of the two-year period the win rate of DV360 and the non-Google DSPs are very similar. However, since May 2019 the win rate of the aggregate DSPs has been notably higher than that of DV360. Overall this suggests that the larger volume of ads purchased by DV360 compared to all other individual DSPs is not necessarily due to it winning a significantly higher proportion of the impressions that it competes for, but is instead due to it competing for a higher overall number of impressions than each of its rivals.

Figure C.68: Monthly average win rates (impressions won/bids made) of DSPs (2018-2019)



Source: CMA analysis of DSPs' data.

[118] No win rates for Google Ads are available. Google Ads often operates as an ad network with Google Ad Sense or Google AdMob and therefore is often not competing in auctions in the same way as most other DSPs.
[119] Note that we only received reliable win rate data from a limited number of DSPs.

Annex

1. As discussed above, we set out a practical example in this annex explaining our calculations of revenue per search using a fictional simplified dataset where only two distinct queries appear in each of Google and Bing: “cheese” and “pear”.

Event	Engine	Platform	Query	Outcome
G1	Google	Desktop	“cheese”	0.2
G2	Google	Desktop	“cheese”	0.4
G3	Google	Desktop	“cheese”	0.6
G4	Google	Mobile	“cheese”	0.4
G5	Google	Mobile	“cheese”	0.6
G6	Google	Desktop	“pear”	0.1
G7	Google	Desktop	“pear”	0.3
G8	Google	Mobile	“pear”	0.3
B1	Bing	Desktop	“cheese”	0.8
B2	Bing	Desktop	“cheese”	0.4
B3	Bing	Mobile	“cheese”	0.3
B4	Bing	Desktop	“pear”	0.3

2. In this case, the averages will be computed as follows:

$$\text{Average Outcome for Bing} = \frac{(\text{Avg Bing for "cheese"} * \text{Times "cheese" appears}) + (\text{Avg Bing for "pear"} * \text{Times "pear" appears})}{\text{Times "cheese" appears} + \text{Times "pear" appears}}$$

which for desktop search events amounts to:

$$\text{Average Outcome for Bing (Desktop)} = \frac{\frac{0.8+0.4}{2} * 5 + \frac{0.3}{1} * 3}{5+3} = 0.4875$$

and for mobile search events:

$$\text{Average Bing (Mobile)} = \frac{0.3 * 3 + 0}{3+0} = 0.3$$

3. For Google, the equivalent calculations would be:

$$\text{Average Outcome for Google (Desktop)} = \frac{\frac{0.2+0.4+0.6}{3} * 5 + \frac{0.1+0.3}{2} * 3}{5+3} = 0.325$$

$$\text{Average Outcome for Google (Mobile)} = \frac{\frac{0.4+0.6}{2} * 3 + 0.3 * 0}{3+0} = 0.5$$

(Note here that “pear” does not appear on Bing, so it has weight zero for Google as well).