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Merger Policy in Digital Markets: An *Ex-Post* Assessment*

Elena Argentesi, University of Bologna

Paolo Buccirossi, Lear

Emilio Calvano, University of Bologna, Toulouse School of Economics and CEPR

Tomaso Duso,+ Deutsches Institut für Wirtschaftsforschung (DIW Berlin), TU Berlin, CEPR, and CESifo

Alessia Marrazzo Lear and University of Bologna

Salvatore Nava Lear

Abstract: This paper presents a broad retrospective evaluation of mergers and merger decisions in markets dominated by multi-sided digital platforms. First, we document almost 300 acquisitions carried out by three major tech companies –Amazon, Facebook, and Google – between 2008 and 2018. We cluster target companies on their area of economic activity providing suggestive evidence on the strategies behind these mergers. Second, we discuss the features of digital markets that create new challenges for competition policy. By using relevant case studies as illustrative examples, we discuss theories of harm that have been used or, alternatively, could have been formulated by authorities in these cases. Finally, we retrospectively examine two important merger cases, Facebook/Instagram and Google/Waze, providing a systematic assessment of the theories of harm considered by the UK competition authorities as well as evidence on the evolution of the market after the transactions were approved. We discuss whether the competition authority performed complete and careful analyses to foresee the competitive consequences of the investigated mergers and whether a more effective merger control regime can be achieved within the current legal framework.

JEL codes: L4, K21

Keywords: Digital Markets, Mergers, Network Effects, Big Data, Platforms, Ex-post, Antitrust

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+ *Corresponding author*. Deutsches Institut für Wirtschaftsforschung (DIW Berlin), Mohrenstr. 58, 10117 Berlin, Germany. Email: tduso@diw.de, Tel: +49 30 89789 520.

1. Introduction

There is a mounting concern that competition authorities (CAs) are putting too much weight on the risk of an incorrect intervention (type I error) over the risk of an incorrect clearance (type II error) when assessing mergers within economic activities that are enhanced by digitization (in what follows referred to generically as "digital markets"), leading to increased concentration. Indeed, the nature of competition in many digital markets may change the terms of the usual trade-off between these errors. Network effects often make the structure of these markets quite concentrated and barriers to entry rather high. Big data may contribute to such outcomes, to the extent that the data endowments enjoyed by incumbents provide a competitive advantage that makes it even more difficult to challenge them. The main mechanism left to discipline incumbents is that of competition *for* the market, i.e. potential and actual entry that may mitigate the ability of incumbents to exert market power. This makes potential competitors even more valuable than they usually are in traditional markets, making type II errors particularly costly. In other words, certain features of digital markets may justify some changes in the way mergers are typically assessed.

Mergers may prevent the development of competitors in two main ways. Either directly, when the incumbent acquires an entity that is an actual or potential competitor; or indirectly, when the incumbent acquires an entity that supplies a complementary or otherwise related product/service, thereby depriving its (actual or potential) competitors of the opportunity to do the same and improve their products to better challenge the incumbent.

To assess whether a merger will be detrimental to competition, CAs would need to predict the evolution of the market in the absence of the merger, i.e. the counterfactual. This is especially challenging when, as is often the case, targets are firms in the early stage of their development. In markets as dynamic as digital markets, young and innovative firms may grow and challenge the incumbent's position through independent decisions and/or investments made by venture capitalists and/or become the target of other entities in the industry that integrate it in their own operations. Hence, when defining the counterfactual to a merger, CAs may need to consider the ability of the target to develop on its own or by attracting outside resources, as well as the likelihood of an alternative buyer coming along.

In this paper, we discuss these issues by performing a broad *ex-post* evaluation of mergers and merger decisions in digital markets. The paper is largely based on a study we conducted for the UK Competition and Markets Authority (henceforth "CMA") – see Argentesi et al. (2019). In our work for the CMA, we were given access to a wealth of internal documents and submissions that, together with recent advances in the literature, allowed us to provide a more accurate *ex-post* assessment.[1] One important novelty of our study is to undertake a less common form of *ex-post*

[1] This paper does not rely on or disclose any of the confidential information we were given access to during our work for the CMA.

assessment. We look back at the original analysis made by the authorities to assess whether the decision the authorities' took was reasonable based on evidence that was, or would reasonably have been, available at the time.[2]

The paper is divided in three parts. Section 2 motivates the study documenting the wealth of mergers and acquisitions (M&A) activity carried out by key digital platforms, such as Google, Facebook, and Amazon, between 2008 and 2018. We go further, attempting to assess the strategy behind these mergers and, consequently, to inform the later discussion of potential anticompetitive threats.[3] Companies active in digital markets are remarkably active in M&As, constantly seeking out interesting start-ups and purchasing them. Such acquisitions may have a variety of purposes: for instance, they may be conducted to secure a technology to be incorporated into the acquirer's product; or to secure highly skilled staff and use their expertise to develop products. However, such acquisitions may also have the intention or effect to wipe out potential competitors. Buying out firms at an early stage of their development may effectively prevent them from ever becoming a competitive threat, as the innovation that they were developing will not serve to displace incumbents but will rather be instrumental to maintaining their market leadership or will be discontinued altogether.

Section 3 provides a discussion of features of digital markets that create new challenges for competition policy such as network effect, multi-sidedness, big data and rapid innovation. We then discuss a set of Theories of Harm (ToHs) that have been developed by CAs in recent merger cases or that have been floating in the economic literature but have not yet found their way in actual cases. We elucidate these ToHs by providing very short illustrative examples of cases where they have been – or could have been – applied.

Section 4 is the centerpiece of the paper, providing our *ex-post* evaluation of two prominent merger decisions by the UK antitrust authorities on key players: Facebook/Instagram and Google/Waze. We assess whether the ToHs pursued by the authorities were addressed correctly and whether there were any other ToHs that would have been reasonable to pursue. We then look at the market evolution following the mergers to ascertain whether the merger has led to a detrimental outcome. Specifically, we evaluate how the markets affected by the mergers have evolved since the merger and rely on qualitative evidence to investigate whether, and to what extent, the merger determined the outcome observed. For each case, we identify the relevant competitive parameters to assess

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[2] Buccirossi et al. (2008) defined this part of an *ex-post* evaluation as "the assessment of the analysis that underpins the decision." To the best of our knowledge, this approach has never been used in the existing literature on merger retrospectives.

[3] Gautier and Lamesch (2020) is complementary to this part of our study. They also considered the acquisitions undertaken by Google, Amazon, Facebook, Apple, and Microsoft (the GAFAM), although for a much shorter period (2015-2017). Differently than we do, they categorize acquisitions based on user groups instead of functionality. They suggest that the GAFAM focused their acquisitions activity mostly on their core market segments and that most of the acquired products were shut down. However, they do not find evidence for so called "killer acquisitions".

market outcomes and assess their evolution since the merger date. Qualitative evidence coming from industry reports and interviews with merging and third parties are used to interpret and corroborate the quantitative analyses.

This paper contributes to a lively and cross-disciplinary debate on how to rethink competition policy for the digital era. Three recent and very influential reports set the stage[4] highlighting a number of pressing competition policy issues and putting forward proposals to promote an international agenda to deal with such concerns. The reports focus on broad issues that cut across markets and (oftentimes) industries, deriving general guiding principles. They all call for legislative reforms, and a more prominent role of *ex-ante* rules. Some of them even call for the possible set-up of a new regulator. Complementary to these studies, in this paper we examine some important merger cases, providing systematic evidence where data were or later became available. We also discuss whether CAs performed complete and careful analyses to foresee the competitive consequences of the investigated mergers and whether a more effective merger control regime can be achieved within the current legal framework.

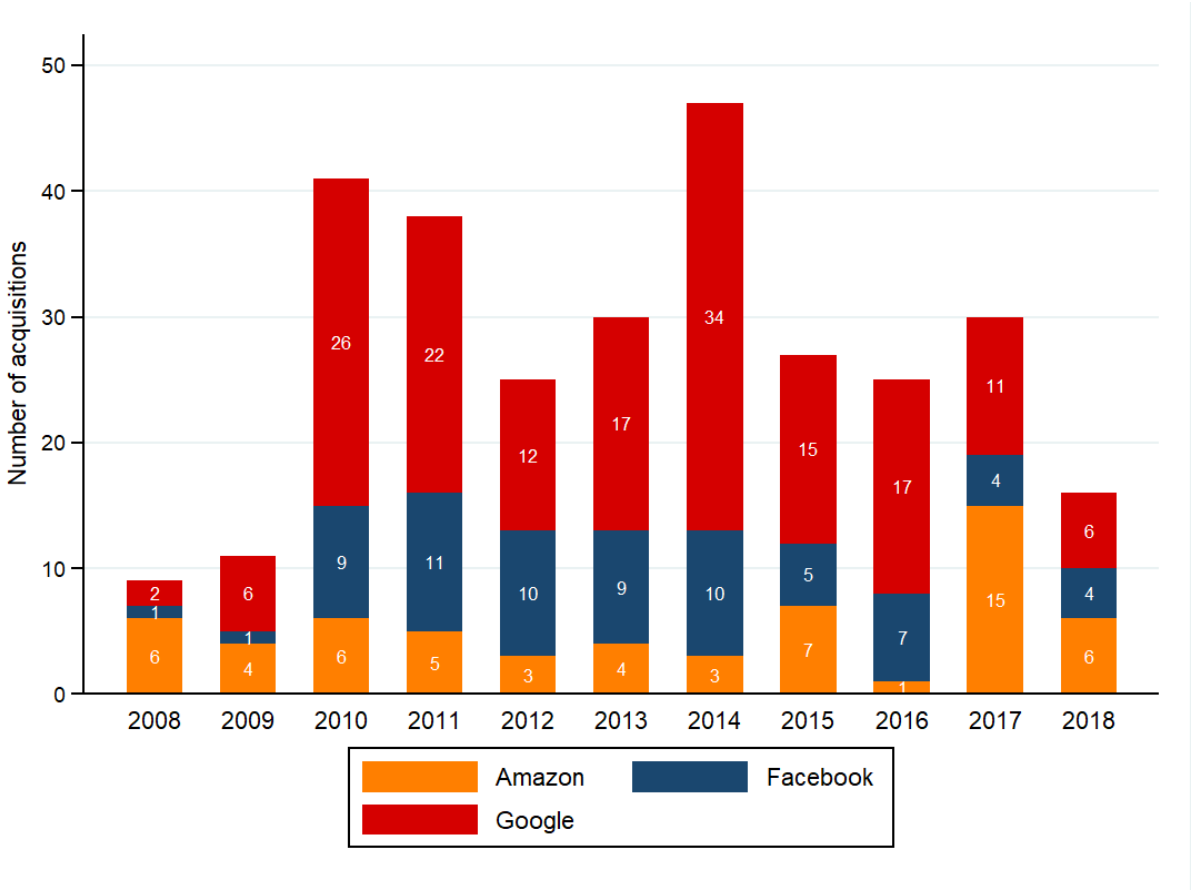
2. Overview of past transactions carried out by leading digital companies

Analyzing the characteristics of M&A activity carried out by major digital companies may help understand whether such activities should be reason for concern. Our analysis covers all the publicly disclosed acquisitions carried out by Amazon, Facebook, and Google between 2008 and 2018, listed in the Appendix.[5] Over this period, Google has acquired 168 companies, Facebook has acquired 71 companies and Amazon has acquired 60 companies, i.e. around 15, 6, and 5 transactions per year on average. Figure 1 shows the number of acquisitions per year for each company. While Facebook and Google have been more active in the period 2010-2016, Amazon's number of acquisitions rose in more recent years.

[4] Crémer et al. (2019) - European Commission, Scott Morton et al. (2019) - Stigler Center, Furman et al (2019) – UK Government. See also Ennis and Fletcher (2020) for a review and comparison of these influential studies.

[5] We focus on these three firms because they were involved in the mergers for which we undertook the ex-post assessment exercise for the CMA. Gauthier and Lamesch (2020) also considered the acquisitions undertaken by Apple and Microsoft, although for a shorter period. They report that other big tech firms, such as Twitter, AirBnb, Uber and Netflix, are less active in acquisitions.

Figure 1: Acquisitions by Amazon, Facebook and Google (2008-2018)



In order to understand the characteristics of the targets, we undertook desk research to understand what the main activity of the target was at the time of the merger based on the description of each target from the Crunchbase database and other sources.[6] Targets were then grouped into clusters that convey the general area of economic activity they operated in.

Table 1 shows the clusters defined for the analysis, along with the number of transactions falling into each cluster. Figure 2 shows the distribution of transactions across clusters for each of Amazon, Facebook, and Google, excluding the *Other* cluster. Google has been remarkably more active than Amazon and Facebook, having bought out more companies than the other two in each of the clusters. Figure 2 also suggests a relatively strong focus by Amazon and Facebook on *Physical*

[6] Crunchbase is a platform for finding business information about private and public companies (https://www.crunchbase.com/). Where necessary, information available on Crunchbase has been complemented with other publicly available sources.

goods and services and *Communication apps and tools* respectively, whereas Google's acquisitions are more evenly spread out across clusters.[7]

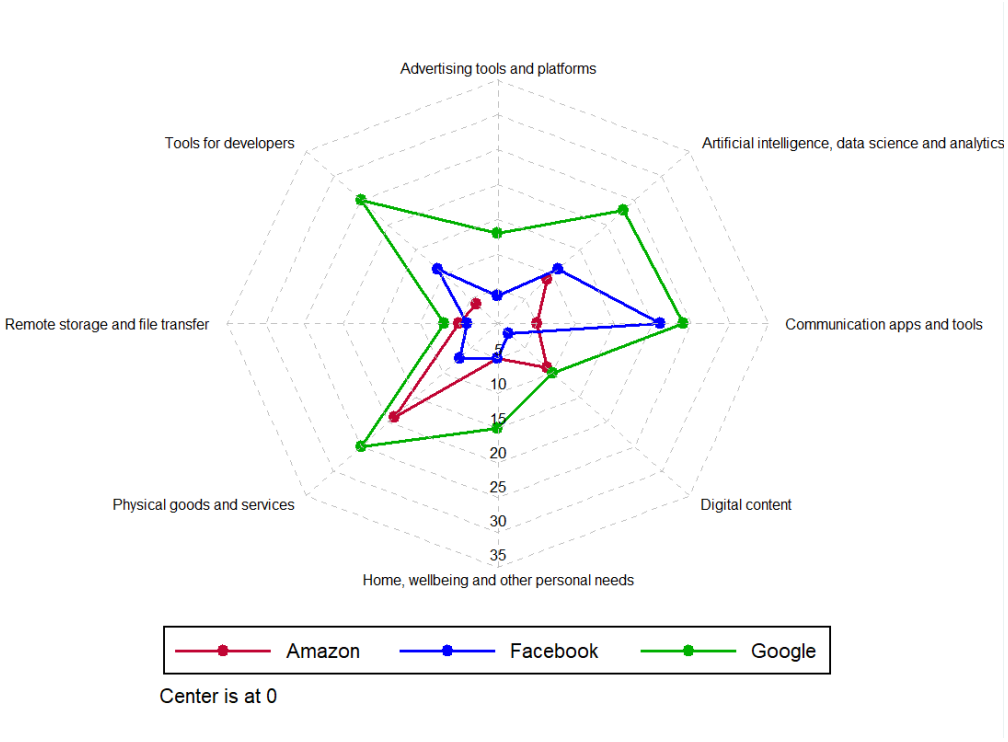
Table 1: Clusters for analysis of past acquisitions by Amazon, Facebook and Google

Cluster	Description	Number
Communication apps and tools	Companies active in the supply of platforms that create or simplify ways of interaction between individuals and/or within organizations. Such ways of interaction include direct communication, such as messaging and emailing, and sharing of content and personal information	50
Tools for developers	Companies that provide tools and solutions for software developers to create and optimize their digital products. This excludes products and services supplied to final consumers	40
Physical goods and services	Companies that manufacture, distribute or sell physical goods of any kind or facilitate through services and software such activities, including price comparison websites, marketplaces and online retailers	51
Digital content	Companies that deliver, create or facilitate the fruition of digital content such as movies, games, digital text and other digital media	21
Remote storage and file transfer	Companies that provide file storage, cloud, file sharing and related services	16
Advertising tools and platforms	Companies active in the advertising industry as provider of advertising content, advertising platforms or active as intermediaries between advertisers and consumers or advertisers and suppliers	17
Artificial intelligence, data science and analytics	Companies active in the creation, distribution or enhancement of self-learning software, image, speech or text recognition software, virtual assistants, analytics and machine learning services for big data	43
Home, wellbeing and other personal needs	Companies active in the provision of software and applications designed to simplify and/or improve experience for different aspects of daily life such as: transportation, health, learning, entertainment, wellbeing and home automation	25
Other		36
Total		299

Source: Lear based on Crunchbase data

[7] Facebook's distribution would likely be even more skewed towards the *Communication apps and tools* if transactions were weighed using the value of the transaction, due to the high-profile acquisitions of Instagram and WhatsApp. However, information on the value of the transactions is not available in a consistent manner.

Figure 2: Distribution of past acquisitions by cluster



Source: Authors based on Crunchbase data

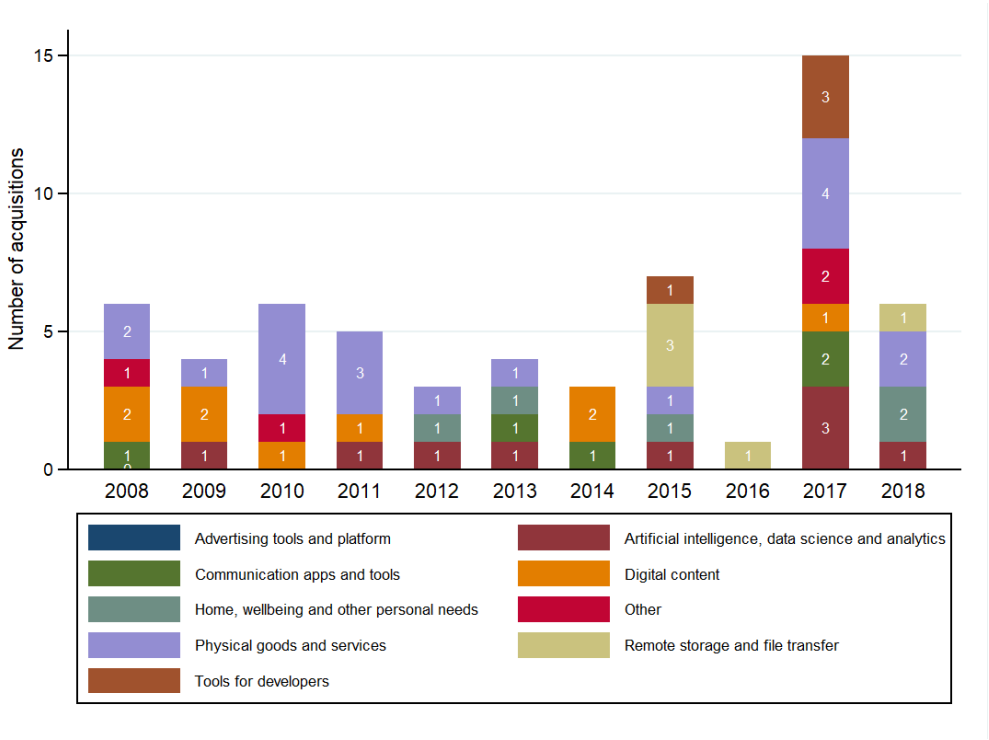
It is not straightforward to assess the nature of these transactions (horizontal, vertical, or conglomerate) on the basis of the available evidence, because the area of economic activity is at most a proxy for actual or potential substitutability. Products may for instance lie in different steps of the value chain or perform different functions. However, most transactions do not have a clear horizontal element for each of Amazon, Facebook and Google. Acquisitions target companies spanning a wide range of economic sectors and whose products and services are often complementary to those supplied by Amazon, Facebook and Google. This highlights the complexity of the business models pursued by digital companies, as several activities seem to enter into their productive process. Transactions that can be characterized as more horizontal in nature would seem to be the minority.

Moreover, Amazon, Google, and Facebook have all invested in companies that have helped them with advanced data analytics techniques (*machine learning*, *artificial intelligence*, *analytics and big data*). The latter is indeed the third cluster in order of importance, and in which we see a relevant amount of transactions for all the three companies. This is consistent with the fact that these companies rely heavily on predictions to provide their services, as discussed in the section that follows. For instance, Amazon uses them to manage its inventory based on expected demand; Facebook to propose targeted content and ads to its users; Google to improve its search algorithms and target ads more accurately. If this is the case, then these mergers may be efficiency-enhancing

as they enable incumbents to become better at making such predictions. On the other hand, the improvement of prediction algorithms through external growth, complemented with the increasing collection of big data containing personalized information and with pervasive network effects, might help these firms cement their dominant position in the market by creating unsurmountable barrier to enter for potential competitors.

Figures 3, 4, and 5 show how the number of acquisitions and their distribution across clusters has evolved over time, for each of the three companies.

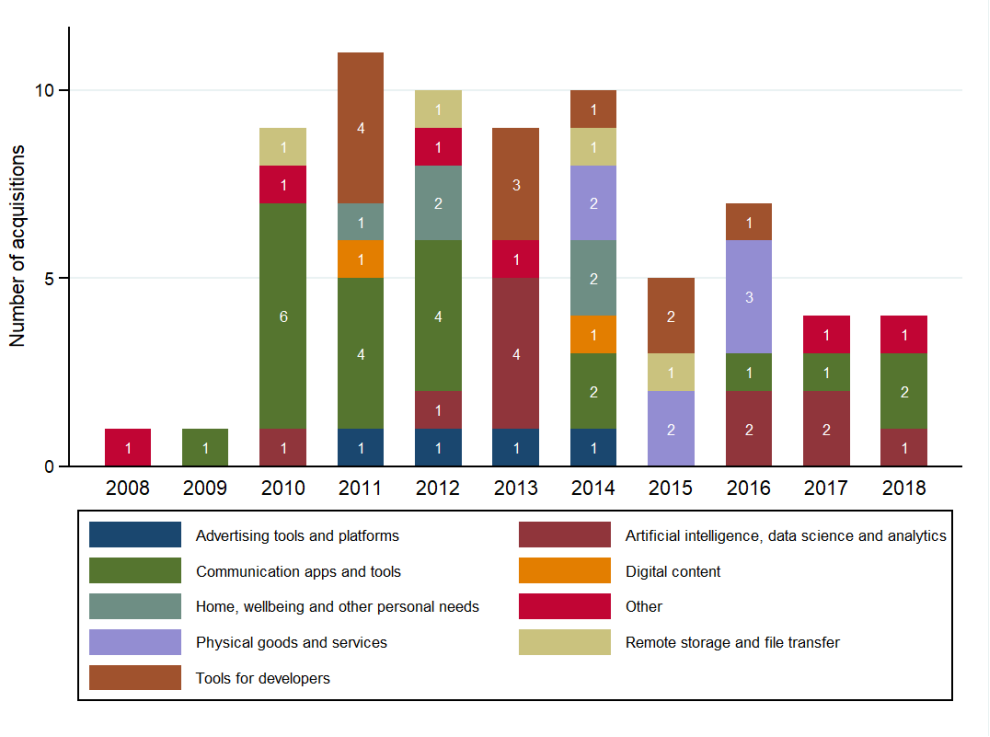
Figure 3: Number of acquisitions by Amazon over time



Source: authors based on Crunchbase data

As we can see from Figure 3, Amazon's acquisitions are clustered in the latter part of the period, with a peak in 2017. Between 2008 and 2013, Amazon completed several acquisitions in the *Physical goods* cluster; most of these were acquisitions of retail operators such as Buy VIP in 2010 and LoveFilm and The Book Depository in 2011. Starting in 2015, Amazon acquired companies in the *Remote storage and file transfer* cluster, perhaps with a view to bolster its own operations in this sector, where Amazon is active with Amazon Web Services. Other notable acquisitions by Amazon include Whole Foods Market, a supermarket chain, acquired in 2017 for 13.7 billion, and Zappos, an online shoes retailer acquired in 2009 for 1.2 billion.

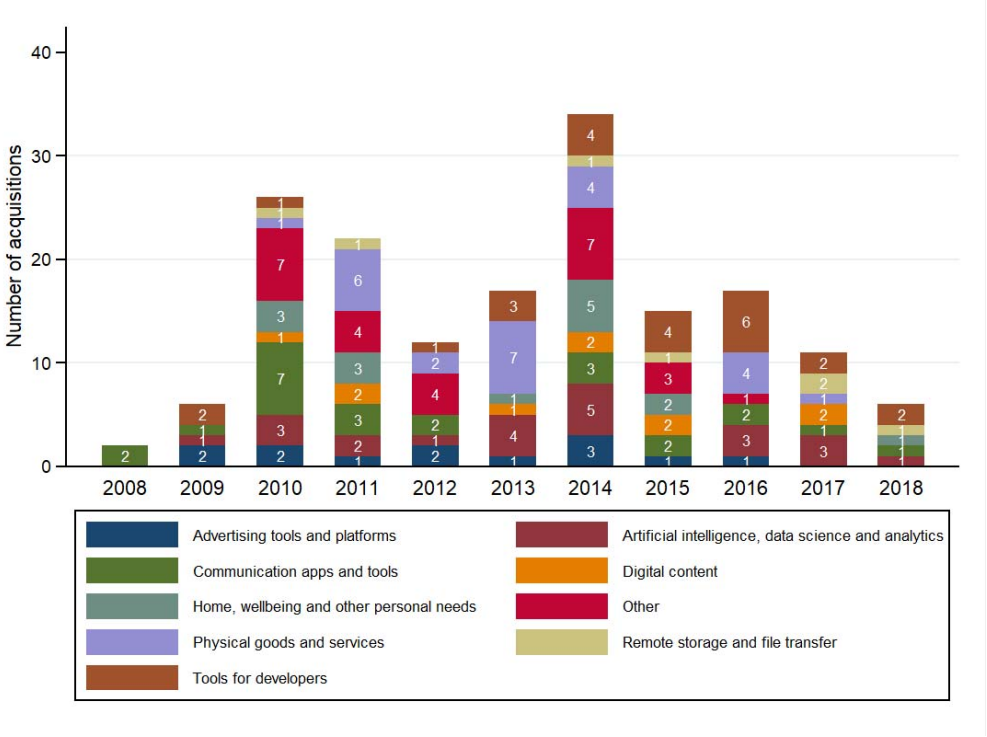
Figure4: Number of acquisitions by Facebook over time



Source: authors based on Crunchbase data

Figure 4 shows that Facebook was remarkably active in M&As between 2010 and 2016. Between 2009 and 2012, Facebook expanded its presence in the *Communication apps and tools* cluster with the notable acquisitions of the messaging app Beluga (2011), later transformed into Facebook Messenger, and Instagram (2012). From 2014 to 2016, Facebook consolidated its position in this segment with the acquisition of Whatsapp (2014) and invested in companies related to virtual reality technologies such as Oculus (2014) and Surreal Vision (2015).

Figure5: Number of acquisitions by Google over time



Source: authors based on Crunchbase data

Finally, Figure 5 suggests that Google has been active throughout the whole period with a peak of M&A activity in 2014. Google's acquisitions do not follow a recognizable pattern and seem to be spread evenly across clusters. However, from 2013 to 2016, there were a number of acquisitions in the *Tools for developers* cluster, presumably to sustain Google's push into the mobile landscape that was expanding rapidly in those years. Finally, Google invested in *Artificial Intelligence data science and analytics* consistently throughout the period with the most notable acquisition being DeepMind in 2014.

Another striking feature of acquisitions carried out by Amazon, Facebook, and Google is the very young age of the targets. At the time of the acquisition, targets are four-years-old or younger in nearly 60% of cases. More specifically, the median age of Amazon's targets is 6.5 years; that of Facebook's targets is 2.5 years; and that of Google's targets is 4 years.

Amazon's relatively high mean age of companies acquired is the result of three acquisitions of long-established retailers, namely the publishing houses Avalon Books and Toby Press, and Whole Food Market. In general, most of the companies acquired by Amazon were between five- and nine-year-old, which suggests a strategy of buying relatively more established firms rather than new-born start-ups.

Facebook acquired companies whose mean age is significantly lower than Amazon's or Google's. This is particularly evident for Facebook's push into virtual reality, accomplished through the acquisition of three companies (Oculus VR, Surreal Vision and Two Big Ears) less than three-year-old. Similarly, all acquired companies in the *Photo apps* and *Direct messaging and calls* clusters were less than three-year-old, with the only notable exception being WhatsApp, which was five-year-old.

Google's acquisition pattern with respect to the age of targets is more heterogeneous than Amazon's or Facebook's. It seems that Google undertook a diversified expansion strategy, aimed at acquiring, for each cluster of activity, both young, riskier start-ups as well as firms in a later stage of development.

As the analysis in Section 4 shows, there are considerable difficulties in understanding the competitive implications of acquiring a young firm as, at that stage in its life cycle, its evolution is still uncertain and, thus, it is very difficult to determine if the target will grow to become a significant competitive force. Moreover, while non-horizontal mergers present significant scope for efficiencies, the realization of these efficiencies may enable incumbents of digital markets to preserve their leadership and preventing other market players from challenging them.

Notice that the above analysis is based on the number of acquisitions only. It would of course be useful to weigh transactions by their value, particularly due to the high-profile acquisitions of Instagram and WhatsApp. However, information on the value of the transactions is not available in a consistent manner. This information would also be useful to gather evidence on the aggregate value of transactions, which would allow to address the issue of *stealth consolidation* (Wollmann, 2019), i.e. the cumulative effect of a large number of small transactions.

3. Key features of digital markets and Theories of Harm

As it appears evident, the number of acquisitions by major tech companies is unusually large and their nature is unusually complex if compared to other sectors: these elements alone create new challenges for antitrust enforcers. Furthermore, there are several specific features of digital platform markets that further exacerbate these challenges, such as network effects, multi-sidedness, big data, and rapid innovation.[8] In this section, we survey recent merger cases to assess how and to what extent CAs have adapted to such challenges, and in particular which ToHs have been developed. We also survey potential ToHs that have been floating in the Economics literature but have not yet found their way in actual cases. We try to plastically illustrate these ToHs by providing very short illustrative examples of cases where they have been – or could have been– applied.

[8] See Calvano and Polo (2020) and Argentesi et al (2019) for a review of the economics literature.

The goal is to set the stage for the in-depth retrospective evaluation of the Facebook/Instagram and Google/Waze cases, to the extent that ToHs developed by CAs and insights from the economic literature may help pinpoint competitive implications of these mergers that the authorities may have missed.

Loss of competition due to network effects

Direct and indirect network effects are possibly the most central element of digital platform markets.[9] When the value that consumers derive from a product depends on the number of other consumers who use the same product, as is often the case in activities enhanced by digitization, markets may have a tendency to become highly concentrated, possibly tipping into monopoly. This implies that competition *for* the market, rather than *in* the market, is often the main mechanism to prevent incumbents in digital markets from exerting market power. In this context, the most recent literature introduces and studies the notion of "incumbency advantage" (Biglaiser, Calvano and Cremer, 2019). It captures the idea that an installed base of consumers may prevent entrants from penetrating the market despite the latter being endowed with better quality products. Some early contributions refer to this as "excess inertia."[10]

For their potential to confer the merged entity a significant degree of market power, network effects are sometimes central to some ToHs considered by competition authorities in their assessment of digital mergers. One decision in which network effects played an important role is the *Microsoft/Skype* case.[11] Microsoft, which was active in the design, development and supply of computer software and related services, also operated two communications services: "Windows Live Messenger" (WLM) for consumers and "Lync" for enterprises. Skype offered a software for communications over the Internet. The parties' services presented three main functionalities: instant messaging, voice, and video calls. While the Commission did not conclude on whether the market should be fragmented by functionalities, the horizontal assessment focused on video calls since the transaction led to the creation of a market leader only with respect to this service. The Commission considered that network effects represented a barrier to entry and expansion in this market, as suggested by respondents to its market investigation, so that the merged entity's ability to exert market power post-transaction could be strengthened. However, the Commission pointed to the fact that most users make voice and video calls with their "inner circle," usually comprising four to six people, making it easier for these small groups to switch to other providers and

[9] Firms active in digital markets typically leverage on technology to enable users to interact among themselves. For this reason, they are typically referred to as "platforms." Markets where the value that users on one side of the market assign to the platform depends on how many users on other sides of the market also patronize the platform are called "multi-sided" following a literature pioneered by Caillaud and Jullien (2003), Rochet and Tirole (2003, 2006), and Armstrong (2006).

[10] Early contributions focusing on the notion of switching costs include Farrell and Saloner (1986), Katz and Shapiro (1992), and Fudenberg and Tirole (2000). More recently, Halaburda, Jullien and Yehezkel (2018), Halaburda and Yehezkel (2016) and Biglaiser and Cremer (2018) relooked at this issue emphasizing the role of favourable expectations as a driver of the incumbency advantage.

[11] European Commission Decision of 7 October 2011 in Case M.6281– Microsoft/Skype, section 3.

mitigating the anticompetitive potential of network effects. Moreover, the Commission observed that users multi-home to a certain degree[12] implicitly recognizing it as a mitigating factor since having a large network did not automatically imply that users would give up using competing consumer communications services.

Loss of competition in markets for attention

A large number of digital products and services are offered free of charge to consumers and paid for with advertising revenues within so-called "markets for attention."[13] Online advertising alone accounts for a large fraction of total media advertising spending.[14]

Mergers involving companies in competition with one another for consumer attention may increase these companies' ability to exert market power within fairly broad online advertising markets, even where the services they supplied to consumers were different and not substitutable to one another. For example, while providing very different services, Google's and Facebook's core products (a search engine and a social media) siphon from the same pool of advertising dollars of around 200 billion a year in 2019 (and rising).

A recent academic literature emphasized the important role that consumer multi-homing has in shaping outcomes such as prices, profits and investments in the attention markets.[15] Multi-homing – which is consistently regarded as a factor mitigating the anticompetitive effects of mergers in markets with network effects – can become a source of market power when it is across the merging parties' products. This is because a subset of previously multi-homing users may become exclusive to the newly merged entity, thus making it a bottleneck provider of these users' attention.

Advertisers are obviously willing to pay more for "exclusive" eyeballs – that is eyeballs that can be reached through multiple means. This means that platforms (i.e. content providers) not only care about the *size* of their audiences but also about their *composition* (i.e. the share of exclusive or multi-homing users), and that CAs should carefully assess how a merger between platforms can affect both dimensions. According to the literature, three factors seem to play a particularly important role in making one provider of advertising space more or less attractive from the perspective of advertisers:

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[12] In particular, the merging parties submitted evidence revealing that [20-30]% of WLM users were also Skype users and that a significant number of Skype IM users were also connected to Yahoo! Messenger, WLM, and AIM, while also visiting Gmail and Facebook.

[13] Anderson and Coate (2005) offer an early contribution.

[14] According to eMarketer, online advertising made ca. 50% of total media ad spending in 2019 and is expected to rise to over 60% by 2023 (https://www.emarketer.com/content/global-digital-ad-spending-2019).

[15] See Ambrus et al. (2016), Anderson, et al. (2018), Athey et al. (2018) and Prat and Valletti (2019).

- *User base's exclusivity*. If certain users can only be reached by advertisers on one platform as they spend most of their time on it, clearly that platform has market power toward advertisers interested in reaching those users. Multi-homing users might become exclusive when platforms integrate through a merger.
- *Platform's reach*. Bigger platforms command a price premium in advertising markets because they allow to reach a larger audience in a more effective way. Athey et al (2018) show that running ads on multiple small platforms leads to inefficient duplication of ads and waste of attention relative to what could be achieved by concentrating all ads on one outlet. This is true to the extent that outlets have a technology that allows to keep track of control.
- *Ability to target ads*. Information on users' behavior collected by digital platforms provides insight into users' preferences and can be used to better target ads. Combining their data endowments, merged entities could become better able to target ads and thus be more attractive to advertisers.

Based on these considerations, Prat and Valletti (2019) go one step further and examine the effects of mergers in attention markets on upstream market structure. If the attention of many consumers becomes concentrated in the hands of a few outlets, then dominant firms can easily foreclose potential entrants (who are not much known and hence need to advertise their products) by siphoning all the attention.

Competing to attract consumer attention does not necessarily imply that a company exploits this attention for monetisation purposes. In *Facebook/WhatsApp*,[16] for instance, WhatsApp was neither selling advertising space nor selling user data. Yet, it did receive potentially valuable consumer attention. Thus, the EU Commission considered whether, post-transaction, the merged entity could analyse WhatsApp users' data and use them to introduce targeted (i.e. more effective) advertising on WhatsApp. This could have enabled Facebook to reinforce its position in the online advertising market with respect to two different possible counterfactuals:

- one where WhatsApp would have stuck to its pre-merger "no ads" strategy. In this scenario, the abovementioned strategy would have allowed the merged entity to increase the ad effectiveness via better targeting and, therefore, making the merged entity more attractive to advertisers, reinforcing Facebook market power in the advertising market;
- one where WhatsApp would have started providing advertising space. In this scenario, the transaction would also remove a competitive constraint, potentially giving rise to unilateral effects in the market for online advertising as absent the transaction Facebook would have faced competition from WhatsApp. In assessing this ToH, the EU Commission noted that this strategy was possible in theory, though it would have required WhatsApp to change its privacy policy.

[16] European Commission Decision of 3 October 2014 in Case M.7217 – Facebook/WhatsApp, section 5.3.2.

Nevertheless, departing from the pre-merger "no ads" product strategy might not be profitable for WhatsApp, as some users might decide to switch to other consumer communications apps. Furthermore, the Commission's investigation revealed that the vast majority of market participants believed that, post-transaction, there would still remain a sufficient number of alternative providers of advertising space competing with Facebook.

Loss of potential competition

Even when the merging parties do not significantly constrain one another at the time of the merger, CAs might investigate whether they would be likely to do so in the future. This requires assessing the likelihood that one of the merging parties will grow into an effective competitive force and whether there would remain a sufficient number of other actual or potential competitors to maintain competitive pressure after the merger.

The *Google/DoubleClick*[17] case provides a good example of this ToH. At the time of the merger, both Google and DoubleClick were active in the online advertising sector. Google was selling ad space on its search engine website Google.com only for search-based text ads. Additionally, it provided ad intermediation services through its ad network (AdSense), selling both search and contextual text ads on the web pages of the publishers participating in the network. Finally, it was offering a bundle encompassing ad space, intermediation services, and ad serving tools. Google was the leading provider of online advertising and, in particular, of search ad space in the EEA. DoubleClick offered a display ad serving technology and it held a leading position on both the advertiser and publisher side of the market.[18] Thus, in its merger investigation, the EU Commission assessed whether 1) DoubleClick could have become a provider of ad intermediation services and, by extension, could have entered the market for the provision of bundled online ad intermediation and ad serving tools; and 2) Google could have become a provider of display ad serving tools. Both moves would have made the merging parties direct competitors, rendering the merger potentially anti-competitive.

The Commission noted that DoubleClick had already planned to enter the market for ad intermediation services by developing an ad-exchange. The Commission went on to assess: 1) whether it was likely that DoubleClick would have evolved in an effective competitive force; and 2) whether there would have been an insufficient number of other competitors left to provide competitive pressure after the merger.

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[17] European Commission Decision of 11 March 2008 in Case M.4731 – Google/DoubleClick, section 7.2.2.

[18] Ad Serving describes the process of delivering ads to viewers. Once ad space has been sold, ad serving is the technology ensuring that the correct ad actually appears (i.e. is served) onto the publisher website space at the right place at the right time. When a user connects to a webpage that features advertising, a server typically identifies the user via unique identifiers hidden in the browser (cookies) then uses the information stored about that viewer to serve him a relevant ad.

In order to answer these questions, the Commission analysed in depth whether DoubleClick held unique advantages that could favour such a development. The Commission identified three types of possible advantages. First, DoubleClick could have leveraged integration between its ad serving technology and its planned ad-exchange to become a player in the online intermediation market. However, the Commission noted that such a combination would not have been unique to DoubleClick, as the market had witnessed a trend towards vertical integration with other intermediation players also benefiting from proprietary ad-serving technologies. In addition, Microsoft and Yahoo!, besides being vertically integrated, also operated a sophisticated ad search business allowing them to offer a larger bundle also including the provision of search ads spaces. DoubleClick would have been unable to replicate such offer absent the merger with Google.

Second, DoubleClick could have leveraged its existing customer base as a key asset that would have allowed it to grow into an effective competitor to Google. However, the Commission first noted that the size of this customer base did not seem to be such that DoubleClick would enjoy a significant advantage relative to its future ad intermediation competitors. Moreover, the Commission noted that there would be difficulties for DoubleClick in converting customers of ad serving tools into exclusive intermediation clients as both publishers and advertisers, especially middle and large companies such as DoubleClick's customers, preferred to use a mix of outlets, i.e. to multi-home.

Third, DoubleClick could have leveraged information about consumer behaviour collected through ad serving services to supply an intermediation service that could not be matched by competitors who do not have access to such data.[19] However, the Commission noted that contractual relations linking DoubleClick with publishers and advertisers severely limited DoubleClick's ability to use this data to deliver services to other advertisers or publishers. The Commission considered that it was unlikely that these contractual restrictions would be removed post transaction. First, DoubleClick probably lacked the ability to impose such changes to its customers, as the available evidence suggested its market power was insufficient. Second, the existence of an incentive to try to do so was also doubtful, since such a fundamental change was considered a factor that could have persuaded many customers to switch to some alternative provider. Finally, such a data endowment would not have been unique and could be replicated by competitors.

The Commission concluded that, while it could not be excluded that DoubleClick would have grown into an effective competitor in the market for ad intermediation services, it was likely that a sufficient number of other competitors would be left in the market exerting competitive pressure to the merged entity post-merger.

The Commission also considered a second ToH related to the possibility that, absent the merger, Google could have become an effective competitor in the provision of display ad serving tools. In

[19] Doubleclick gathers different kinds of users' information such as queries to a search engine, request for the user's name and e-mail address, and GIF tags to track the users' movements through the client web site.

fact, it was working on a new ad serving product that was in the early stages of development. Yet, the Commission found no evidence indicating that Google was likely to grow into an effective competitive force. Indeed, it had no significant experience with display advertising or the advanced metrics required by customers purchasing display advertising. Additionally, other potential entrants into ad serving, in particular ad agencies and web portals, were better placed in terms of customer relationships, as they also provided their customers with rich media ads. Indeed, the Commission noticed that recent entrants into the ad serving market included agents belonging to these two categories (among which Microsoft and Yahoo!). Thus, even if Google were to succeed in the development of its display ad serving technology, it would be just one of many competitors.

Tying, Foreclosure and exclusion with network effects

Network effects, given their potential to represent a barrier to entry or expansion, could increase the likelihood of foreclosure, exacerbating the anticompetitive effects of the merged entity's exclusionary strategies.

This ToH was considered in the *Microsoft/LinkedIn*[20] decision. LinkedIn was the leader in the market for Professional Services Networks (PSN), whereas Microsoft held a strong position in the markets for OSs and productivity software for PCs. The Commission explored whether the merged entity could leverage its strong market position from the markets for OSs and productivity software for PCs to the market for PSN services, thereby reinforcing LinkedIn's competitive advantage in this market and foreclosing its competitors. The strategies that could be pursued by the merged entity were: the pre-installation of a LinkedIn application on Windows PCs; and the integration of LinkedIn features into Microsoft Office, while at the same time denying the same levels of integration to competing providers of PSN services, for instance through denial of access to Microsoft Application Programming Interfaces (APIs).

Both strategies were considered technically feasible and capable of foreclosing competing providers of PSN services; also, the Commission noted that the merged entity was likely to have the incentive to engage in such strategies, as also suggested by Microsoft's internal documents, which explicitly mentioned the opportunities related to implementing these strategies post-transaction.

The Commission then went on to assess the overall likely impact on competition of these practices: this is where network effects come into play. According to the Commission, network effects could make foreclosure of existing competing providers of PSN services more credible through the following mechanism: the more LinkedIn's user base would grow, the more additional users would be willing to join the network and less willing to join instead competing PSN service providers.

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[20] Commission Decision of 6 December 2016 in Case M.8124 – Microsoft/LinkedIn, section *4.2.3*.

The Commission envisaged that this trend could have continued up to the point that the market would "tip" in LinkedIn's favour.

Moreover, network effects could represent barriers to entry for potential competitors, thereby exacerbating the anticompetitive potential of these foreclosing practices. Indeed, the Commission considered that potential entry of new PSN service providers could have, in principle, mitigated the impact of network effects, but concluded that this was not the case.

Another factor considered by the Commission for its potential to mitigate network effects was multi-homing. Yet, in this case, it was considered insufficient. Indeed, multi-homing is likely to be more limited in PSN services as compared to consumer communications services: actively engaging on PSN platforms requires time and effort as users need to create their profile and keep it updated, build their network and interact with new contacts. Through its market investigation, the Commission found that, pre-merger, although many users did have accounts on multiple PSNs, they actively used only one of them or, at least, they viewed one of them as their "main network." This is because network effects, in this case, result from consumers *using* the service. Furthermore, the merger might even make multi-homing decrease for its potential to strengthen LinkedIn's market position and the subsequent reduced incentive for users to invest the effort associated with actively using competing PSNs.

The Commission concluded that these practices, namely the pre-installation of a LinkedIn application on Windows PCs, and the integration of LinkedIn features into Office and denial of access to Microsoft APIs, were likely to foreclose LinkedIn's competitors and have a negative impact on competition. In order to remove these concerns arising from the transaction, the merging parties submitted two sets of commitments. One set of commitments was meant to address the concerns related to the possible pre-installation of a LinkedIn application on Windows PCs; another set of commitments aimed at removing the concerns related to the possible integration of LinkedIn features into Office and denial of access to Microsoft APIs.

Big data as an essential input to compete

The quintessential task of many digital platforms is that of making predictions of various sorts. The data used to make these predictions ("big data") is becoming increasingly relevant to shaping competition.[21] Foreclosure can result from the combination of two previously independent datasets. The creation of a larger or more diverse dataset resulting from a merger may give the merged entity a competitive advantage. However, this potentially negative effect on competition does not result from the mere exertion of market power: rather, it is the result of efficiencies realized by the merging parties that place them ahead of its competitors. In a sense, the restriction to competition

[21] The literature on big data in economics is still extremely scarce. The few exceptions are empirical studies such as Lambrecht and Tucker (2015), Bajari et al. (2019), and Schaefer et al. (2018), as well as theory papers such as Rubinfeld and Gal (2017), Prufer and Schottmüller (2017) and DeCorniere and Taylor (2019).

comes from the merged entity becoming better at what it does and providing more value to its customers. However, CAs and practitioners are voicing concerns that big data may be an insurmountable competitive advantage that incumbents naturally enjoy as a by-product of their operations, further increasing barriers to entry. Mergers may further enrich data endowments – and thus the competitive advantage – enjoyed by incumbents of digital markets.

Access to data was the main source of concern in relation to the *Apple/Shazam* transaction.[22] Apple and Shazam were active in the digital music industry, albeit with different roles. Other than designing, manufacturing, and selling mobile devices and personal computers, as well as developing the operating systems installed on these devices, Apple operated Apple Music, one of the leading music streaming platforms. Shazam not just offered a leading music recognition app for mobile devices and personal computers but was also active in the online advertising market. One of the channels through which it generated revenues was the licensing of music data and analytics services.

The Commission investigated two main ways in which data combination could lead to diminished competition.

First, the Commission explored whether the transaction would give Apple access to commercially sensitive information about competing music-streaming platforms, in particular Spotify,[23] which could put them at a competitive disadvantage in the market for digital music streaming apps and lead to their foreclosure. Indeed, data collected by Shazam included information regarding the user's identity, about the presence of non-pre-installed digital music streaming apps on the mobile devices where Shazam was installed, and some additional pieces of information for those users who have connected their Shazam account with their Spotify account.

Shazam's customer information was considered commercially sensitive as it could help Apple improve the effectiveness of its customer acquisitions strategies by targeting its rivals' customers through advertising or marketing campaigns. The Commission went on to assess whether Apple would have the ability and incentive to use this information to pursue such a strategy and what the overall impact of the strategy on competition would have been.

As regards the ability, the Commission considered that, while from a purely technical point of view this strategy would have been feasible for Apple, there might exist legal or contractual limitations to the use of Shazam's customer information post-transaction. Shazam was able to access data about which apps were installed on a user's Android device because the Android Developer Guidelines allowed it, but this could change at any point in time and was beyond Apple's control.

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[22] European Commission Decision of 6 September 2018 in Case M.8788 – Apple/Shazam, section *8.4.2*.

[23] Spotify was, indeed, the market leader in the European Economic Area (EEA), while Apple Music had rapidly become the second largest provider of music streaming services in the EEA since its launch in 2015.

Regarding the incentive, the Commission noted that Apple's submissions and internal documents stressed that marketing efforts target new subscribers rather than switchers. Moreover, Apple submitted that it planned to change Shazam's data collection practices to bring them in line with Apple's policy: this would have meant that Shazam would no longer collect information on other apps installed on the user's mobile device unless this was consented to by the app developer.

In any case, the Commission concluded that the overall impact of these practices on competition would have likely been limited. Indeed, it noted that the same customer information would have been available to many other players post-transaction; Facebook and Twitter, for instance, collected information on their users' interests. Apple could have relied upon alternative providers to pursue these targeting strategies also before the transaction.

The second way in which data combination could have affected competition is more in line with the "big data" debate. Indeed, the Commission considered whether the data collected by Shazam could have been used to improve existing functionalities, or to offer additional functionalities, on digital music streaming apps, thereby qualifying as an important input with respect to the provision of digital music streaming services. For instance, one such improvement could have been offering better targeted music suggestions to users. If this was the case, denying access to these data to competing providers of digital music streaming services could have significantly impeded competition in this market generating an exclusionary effect. While the Commission considered that the merged entity was likely to have the ability and incentive to use Shazam's data for similar purposes, it also noted that these strategies were unlikely to result in the foreclosure of Apple Music's competitors, and, more generally, to have a significant negative impact on competition. This conclusion was reached based on evidence from the Commission's market investigation suggesting that the type of data collected by music recognition apps did not appear to be an important input. The Commission compared Shazam's data to other available datasets on users of digital music services based on the so-called "four V's":[24] the variety of data composing the dataset; the speed at which the data are collected (velocity); the size of the data set (volume); and the economic relevance (value). It concluded that Shazam's data was not more comprehensive than other datasets available in the market, it was generated at a lower speed and with lower per user engagement, and had never been considered a strategic asset by the merging parties. In conclusion, even if the merged entity were to deny Apple Music's rivals access to Shazam's data, the impact on their ability to compete would have likely been minimal.

Killer acquisitions and the kill zone

[24] These are four relevant big data metrics as suggested in "Competition Law and Data," issue May 10, 2016, as a joint report of the Bundeskartellamt the German National Competition Authority ("NCA") and the French Autorité de la Concurrence, available at http://www.autoritedelaconcurrence.fr/doc/reportcompetitionlawanddatafinal.pdf.

An important aspect of the incumbency advantage, put forward by the economic literature on innovation, is the incentive for incumbents to carry out pre-emptive buyouts; that is, buyouts of entrants with the goal of reducing potential future competition. This so called "entry for buyout" (Rasmusen, 1988) may also end up in the extreme situation of "killer acquisitions," i.e. situations where the acquirer closes down the activity of the acquired entity).[25]

This may be especially problematic in digital markets. The prevalence of network effects makes it such that often competition is *for* the market rather than *in* the market. Consequently, the threat exerted by smaller market players or potential entrants is essential to keep market power in check. If such threats can be easily dealt with through targeted acquisitions, they cease to discipline market behaviour and leave room to the exercise of market power. Moreover, most of this M&A activity occurs below the radar of competition authorities, as the large majority of transactions carried out by digital companies do not meet the relevant thresholds for merger control. Indeed, merger control thresholds are often based on merging parties' turnover, which are rarely met when targets are start-ups that in some instances are still trying to figure out a viable path to monetization.[26]

Kamepalli, Rajan and Zingales (2019) study the effect that the prospect of being acquired by large incumbent plays on the incentives of early adopters and, as a result, on venture capitalists in context with network effects. If early adopters, the argument goes, anticipate that the entrant's product will eventually be integrated with the incumbent's product, they would be less likely to adopt in the first place. This, in turn, will make it more difficult to reach the scale needed to launch these services creating a "kill zone" in the start-up space. They provide anecdotal and systematic evidence on changes in investments to back up this point.

Loss of innovation

When a merger combines two important innovators or eliminates a firm with promising pipeline products, the transaction can lead to a significant impediment of effective competition. Evidence from digital markets is still almost non-existent. Yet, the 2017 Dow/Dupont decision,[27] although it does not concern digital markets, may still provide useful insights as to how to assess mergers that threaten innovation and on the remedies that can be adopted to remove the related competitive concerns.

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[25] More recent works include (theory) Fumagalli et al, 2020; Motta and Peitz, 2020, Kamepalli et al, 2020 and (empirical) Gautier and Lamesch, 2020 and Cunningham et al, 2018.

[26] It is worth noting that different jurisdictions face different rules that might be more or less able to address such issues. For instance, the UK system differs from other systems because of its share of supply test, which is satisfied when the merger creates or enhances a 25 per cent share of supply or purchases of any goods or services in the UK. This test is not based on market share and allows wider discretion and more flexibility in describing the goods or services. See Wollmann (2019) for evidence on the effects of a change in the notification thresholds.

[27] European Commission Decision of 23 March 2017 in Case M.7932 – Dow/Dupont.

The *Dow/Dupont* decision formulated for the first time a loss of innovation ToH whereby the merger may affect the merging parties' incentives to innovate post-merger. The transaction involved two large suppliers of crop protection chemicals and would have created a market leader. The parties to the merger competed as vertically integrated developers and manufacturers of pesticides (herbicides, fungicides, and insecticides). Innovation is considered of particular importance for the crop protection industry, which is highly concentrated. Indeed, farmers value new products that are less toxic or more efficient against pests, which may become resistant to existing active ingredients over time. Thus, innovation is crucial for capturing sales from competitors and defending existing sales. For this reason, within the loss of innovation ToHs, this fundamental role of innovation is highlighted by the fact that firms are assumed not only to compete in relevant product markets, but also in "innovation spaces."

The Commission's concern was that the merger threatened innovation competition by removing the parties' incentives to pursue *ongoing parallel innovation efforts*: the Commission found, indeed, that the parties were competing in important innovation areas. Since innovating in this industry is a lengthy and costly process, the parties would have likely had the incentive to discontinue some of their pipeline products. Moreover, the merger could have hampered innovation by removing the parties' incentives to develop and bring to market new pesticides: the merged entity's overall incentive to undertake innovation was considered to be lower than the sum of its parts. The Commission found that the second effect was likely to be significantly larger than the first one.

Due to the innovation-related concerns, the Commission conditioned the clearance of the merger on the divestment of DuPont's global pesticides business, including its R&D division. The hypothesis was that the buyer of this divestment package would be empowered to replace the competitive constraint exerted by DuPont such that the number of effective competitors in the innovation spaces where DuPont was active would remain unchanged. Including DuPont's R&D organisation and pipeline products was meant to ensure the viability and competitiveness of the divested business in the long-run.

4. Review of two merger decisions taken by UK Authorities

This section represents the central piece of the paper. We perform an *ex*-post evaluation of two widely discussed merger cases, *Facebook/Instagram* and *Google/Wave*.[28] In this evaluation, novel to the extant literature, we do not only aim at studying the market developments after the acquisitions to potentially assess their causal effect, but we also evaluate the appropriateness of the

[28] In Argentesi et al. (2019) we also perform an *ex-post* evaluation for the Priceline/Kayak and Expedia/Trivago mergers in the online travel agencies market as well as merger between Amazon and The Book Depository in the market for online retailing of physical books.

arguments put forward by the Authorities to motivate their decisions. These two specific cases were not only chosen because of their visibility and relevance in the policy debate. Foremost, they were chosen because they were among the very few mergers among digital platforms that underwent a control procedure by competition authorities.

4.1 Facebook/Instagram[29]

The merger between Facebook and Instagram was cleared by the Office of Fair Trading ('OFT') on August 14, 2012.[30] At that time, Instagram provided a free mobile photo app allowing users to take, modify and share photos on Instagram itself or on other social networks, thus making Instagram an input to social networks; whereas Facebook was a digital platform supplying social networking services and had recently launched a mobile photo app, Facebook Camera.

Assessment of the ToHs

The Authorities considered three main ToHs.

Loss of competition. First, the merger would have made the competitive constraint that the parties exerted on each other in the market for the supply of photo apps disappear. This was dismissed based on the existence of several relatively stronger competitors that constrained Instagram more than Facebook did and on the limited attractiveness of photo apps (including Instagram) to advertisers.

The main piece of evidence evaluated by the Authorities to support the conclusion that Instagram and Facebook Camera were not particularly close competitors was the number of downloads of other competing photo apps relative to Facebook Camera. However, using this metric is problematic as it does not reflect user engagement: since downloads are usually free and simple, consumers might decide to try more than one photo app, but actively use only the one(s) that better responds to their needs. Actual usage data may have provided a better insight into closeness of competition. One common way to consider user engagement is to use the number of unique active users, i.e. those that have used the app at least once over a certain time span, or the time spent using the app.

Further, photo apps were not considered by the Authorities to be *per se* attractive to advertisers, since users spent a limited amount of time on them. However, the opinions collected by the Authorities were not unanimous on this point, with some stakeholders pointing out that Instagram held significant advertising potential thanks to a growing and loyal user base. The diverging views of the stakeholders should have prompted the Authorities to collect data and test independently

[29] Emilio Calvano was not involved in the assessment of the *Facebook/Instagram* merger.

[30] Office of Fair Trading Decision of 14 August 2012 in Case ME/5525/12 – Facebook, Inc. / Instagram Inc.

whether users did not spend a significant amount of time on Instagram, rather than rely on the (conflicting) opinions of stakeholders.

Indeed, data we collected – which would have been available at the time – shows that Instagram did generate significant user engagement compared to other photo apps and other social networks at the time of the merger. In September 2012, on average, Instagram's users spent over three times more time on the app than Photobucket's users,[31] with the total minutes spent on the Instagram app thirty times greater than the minutes spent on Photobucket. Moreover, total minutes spent on Instagram by its users, as well the average minutes per user, were not dramatically different from the same figures for Twitter.[32] This indicates that Instagram might have been different from other photo apps in terms of the user attention received and, consequently, of its potential attractiveness to advertisers.

Loss of potential competition. Second, although Instagram was not competing with Facebook for advertising revenues and had limited social network functionalities at the time of the merger, the Authorities' concern was that this could change in the future, i.e. that the merger would remove a potentially significant competitive threat to Facebook in the market for social network services. As in the Google/Doubleclick case discussed above, this amounts to showing whether Instagram had unique advantages that could favor such a development.

The OFT dismissed this ToH because the available evidence did not show that Instagram was particularly well placed to compete against Facebook in the short run and there existed other firms that represented the main constraints on Facebook for brand advertising, such as Google, Yahoo! and Microsoft.

However, the Authorities might have underestimated Instagram's potential to grow into a significant competitive force in the supply of social networking services. For instance, one of Facebook's competitors argued that it would not have been technically difficult or expensive for Instagram to expand its services to a website and to add functionalities similar to Facebook's; and that Instagram's already significant and quickly expanding user base and social graph made Instagram different from other photo apps. This, along with other confidential evidence from the

[31] Photobucket was chosen for this comparison since it was the only photo app for which it was possible to retrieve data and that had a significant presence in the market at the time of the merger.

[32] In particular, ComScore data shows that Instagram's users spent 16.4 million minutes on the app and the average minutes spent on the app by each user were 6.54; Photobucket's users spent 0.54 million minutes on the app and the average minutes spent on the app by each user were 1.84; finally, Twitter's users spent 12.23 million minutes on the app and the average minutes spent on the app by each user were 8.03. The data collected from ComScore does not include the time spent by users under Wi-Fi connection: thus it underestimates the time spent on mobile devices. For this reason, time spent on mobile devices cannot be compared to time spent on desktop, limiting a meaningful comparison time spent on mobile devices only. Despite this limitation, these figures still provide an indication of Instagram's relative position. Photobucket was the only photo app for which these metrics were available that already represented a significant constraint on Instagram, as shown by data on registered and unique users provided by the parties at the time of the investigation.

case file that we cannot disclose, could have advised more caution in dismissing the potential competition ToH.

3. Foreclosure with network effects. At the time of the merger, Instagram allowed photos to be easily reposted across a variety of social networking sites. The Authorities were concerned that the merged entity could either prevent such interoperability or deteriorate its quality, with the intent of foreclosing Facebook's rivals. This vertical ToH was dismissed as it was assumed that Instagram's appeal was in large part due to the possibility to upload photos to other social networks and that limiting this possibility would cause some users to switch to other photo apps, thus being overall unprofitable for the merged entity.

The key argument for the dismissal of the foreclosure of rival social networks ToH was that the incentive to engage in a foreclosing strategy was missing as Instagram's popularity would have likely been negatively affected. According to the Authorities, Instagram owed much of its success precisely to this interoperability. However, the Authorities did not collect evidence to test this empirically: for instance, the Authorities could have sought to measure what percentage of Instagram users used it primarily to upload photos to social networks other than Facebook. Post-merger, the merged entity did limit Instagram's interoperability with other social networks. However, by that time, Instagram was a fully-fledged social network itself, making its relationship with other social networks potentially more horizontal than vertical as will be explained below.

The three ToHs analyzed by the Authorities do not exhaust the range of possible, meaningful ways in which the merger could have harmed competition. We discuss a number of alternative ToHs that could have been considered in light of the ex-ante information.

The Authorities placed significant attention on what the merging parties did, i.e. the particular function that their apps performed. However, even though the apps of the merging parties performed different functions (social networking services and photo apps), Facebook was already in the business of harvesting consumer attention and selling it to advertisers; and Instagram was a potential entrant in such a market. That is, they could have considered a ToH based on the **loss of potential competition in markets for attention.** Indeed, as seen in section 3, this is something that the EU Commission carefully considered in the Facebook/Whatsapp case. In contrast, the Authorities did not thoroughly investigate the advertising side of the market: what is the extent of audience overlap, what would have been the overall reach of the merging party starting from how advertisers make their choices, i.e. what drives their decision to use one platform over another, or to use both. To the extent that advertisers place value on certain characteristics of a platform, and inasmuch as a merger affects these characteristics, it may be possible for the merged entity to exert market power post-merger.

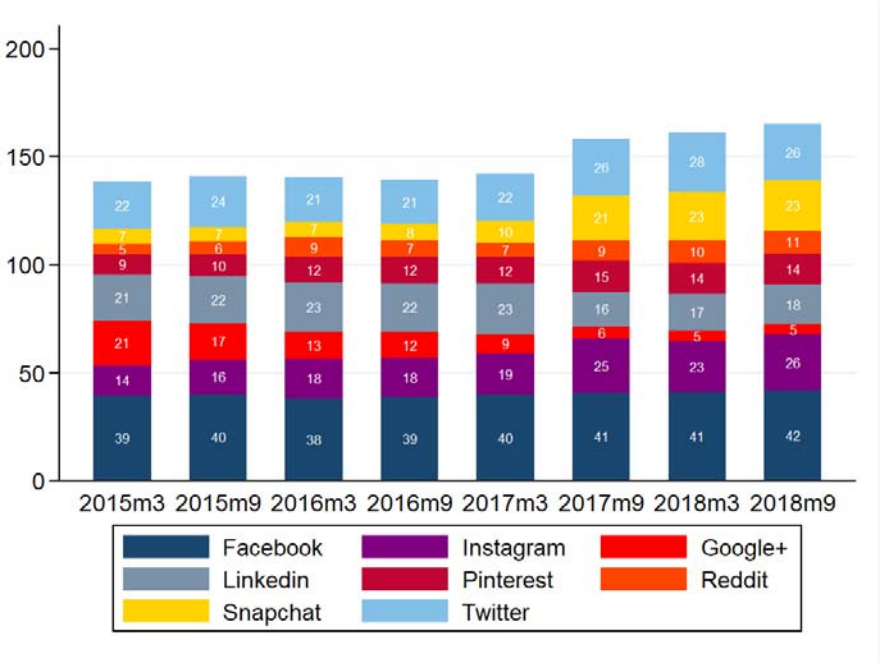
Assessment of post-merger market outcomes

After the acquisition by Facebook, Instagram rapidly evolved into a different product, one that offers fully-fledged social network functionalities, such as direct messaging, photo tagging, and

allows advertisers to place their ads on the platform. Facebook contributed to Instagram's growth by providing improved physical infrastructures as well as its expertise in social networks and advertising markets.

Since the merger, the number of Facebook users in the UK has been relatively stable, while the number of UK Instagram users has doubled, moving from 14 million in March 2015 to 26 million in September 2018 (see Figure 6). In terms of number of users, by September 2018 Instagram was the second largest social network, tied with Twitter.

Figure6: Number of monthly unique users of social networks in the UK (million)

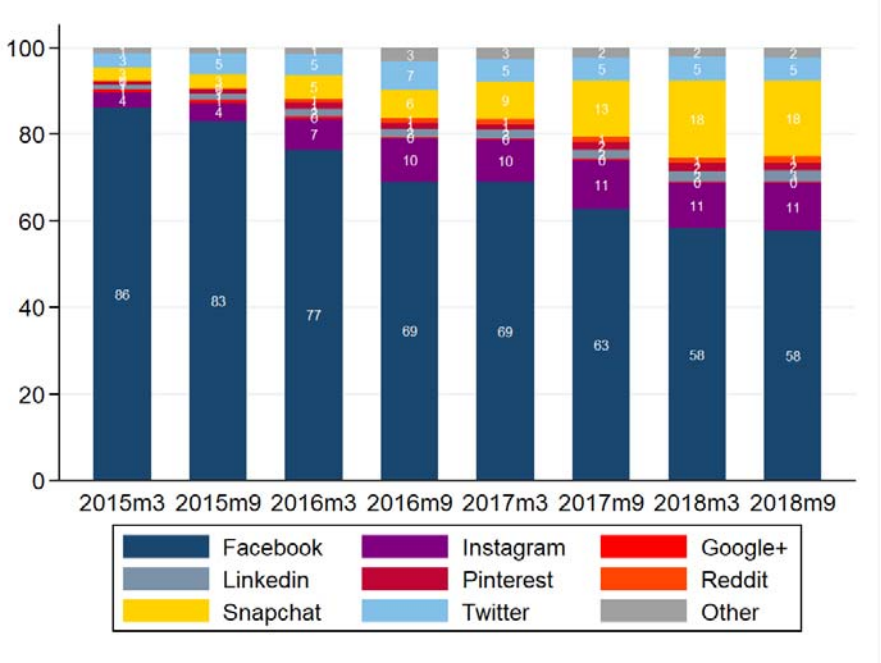


Source: authors based on ComScore data

However, in terms of time spent by users on the platform, Facebook has lost ground with respect to other social networks: the share of time spent by UK users has fallen from 86% in 2015 to 58% in 2018 (see Figure 7). Instagram's share has increased, going from 4% to 11% over the same period. Snapchat is the only other social network that is emerging as a significant challenger to the merged entity, with a share that reached 18% in 2018.[33]

[33] The evolution of the merging parties after the merger has been evaluated with respect to a market for social networks comprising those platforms that (i) enable the connection and interaction among users and, as a result, (ii) can leverage a deep understanding of users, their connections, and their preferences when selling advertising space.

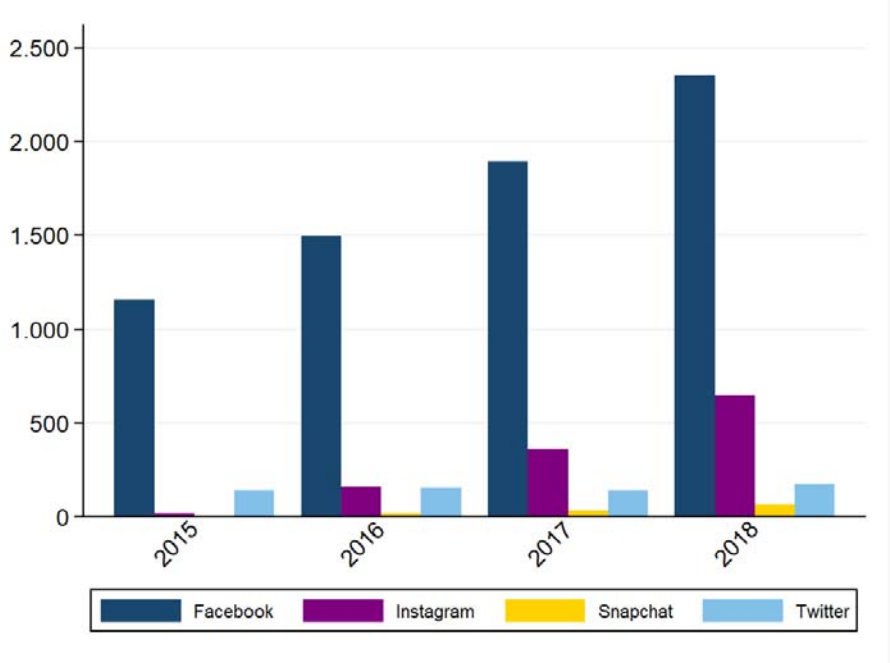
Figure7: Share of monthly time spent on social networks in the UK (%)



Source: authors based on ComScore data

On the other side of the market, Facebook's advertising revenue increased significantly despite the drop in time spent, and the gap between Facebook and other social networks has widened (see Figure8: UK advertising revenue for the main social networks (million GBP)~~Figure 8~~). This seems to suggest that the effectiveness of Facebook's advertising technology has significantly improved over time. Instagram started to monetize in the UK in 2015, and, since then, its revenues have increased significantly – as occurred for the number of users – largely exceeding the revenues earned by other platforms.

Figure8: UK advertising revenue for the main social networks (million GBP)



Source: authors based on eMarketer data (extracted on March 5, 2019)

We also compute the ratio between advertising revenues and the number of hours spent on the platform. This indicates how much each hour spent on a platform is worth, on average, on the advertising side of the market. Assuming that the same volume of ads can be shown in an hour across the various social networks, this metric can be interpreted as a proxy for the price paid by advertisers to reach users on the various platforms. We find that the advertising revenue per hour spent on Facebook and Instagram is significantly larger than that of their rivals, with Snapchat in particular lagging considerably behind the merged entity. Overall, it would seem that the merged entity is able to command higher prices.

As discussed in section 3, this may be a result of the efficiencies achieved through the merger and/or of the exercise of market power by the merged entity. Indeed, the merger has likely contributed to improving the position of the merged entity across many of the factors relevant to advertisers:

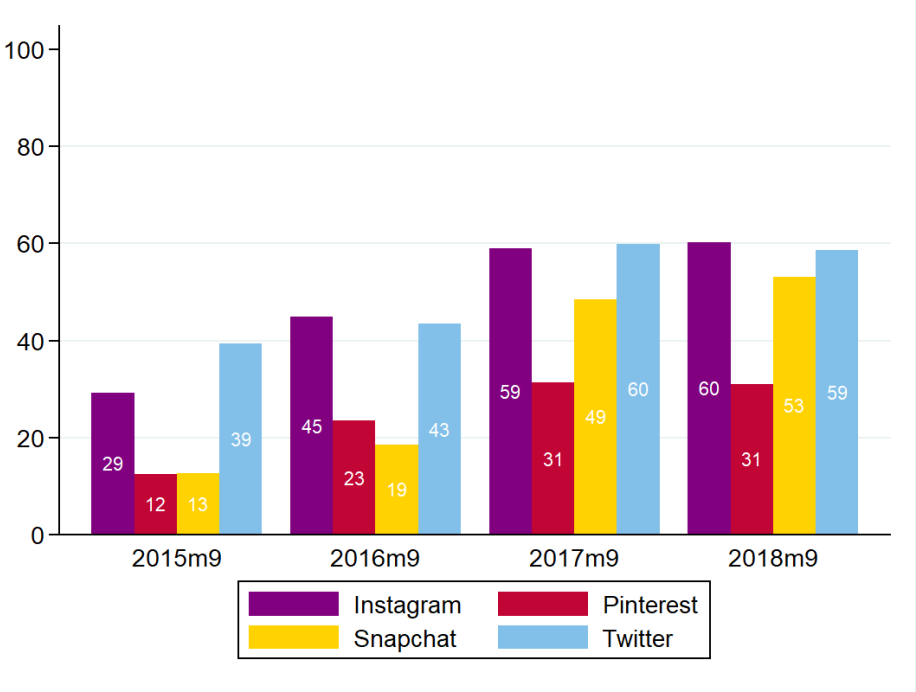
- Facebook uses and combines data from its own website and company-owned services, including Instagram, obtaining a much richer information set that is valuable for targeting ads;
- Facebook no longer faces the competitive constraint that might have been exerted by Instagram on users who cross-visit the two platforms. Figure 9 shows the percentage of Facebook users

who visits other social networks. In 2015, 29% of Facebook users were also visiting Instagram,[34] and the percentage is increasing over time: in 2018, almost 60% of Facebook users are also on Instagram. The overlapping users between Facebook and Instagram foster Facebook's competitive advantage, as these users are now more exclusive than they would have been if Facebook and Instagram were two separate entities;

- Facebook is able to reach a very wide set of social network users, as most users of other social networks also use Facebook, whereas the opposite occurs to a lesser extent. Indeed, in 2015, more than half of the users of the main social networks –Instagram, LinkedIn, Snapchat, and Twitter– were also visiting Facebook (see Figure 10). In 2018, almost all the users of these social networks were also visiting Facebook. By buying advertising spaces on Facebook, advertisers are able to reach almost all of Instagram, Twitter, LinkedIn, and Snapchat users. The opposite is not true: Figure 8 shows that, when selling advertising space on Twitter, advertisers are only able to reach 59% of Facebook users in 2018. On top of this, Facebook can also provide advertisers with access to users who cross-visit Instagram and other social networks. For instance, in 2018, 60% of Twitter users cross-visited Instagram. This gives the merged entity the ability to reach those Twitter users who do not use Facebook but do use Instagram. This is particularly relevant as, thanks to Instagram, Facebook became able to reach demographics where it has lost ground over the past years. Indeed in 2017, the share of monthly time spent on Facebook by users aged 18-24 was as low as 8%, whereas it was 43% in Instagram. By enhancing the size of Facebook and fostering users' engagement, the acquisition of Instagram substantially increased its attractiveness to advertisers and, in turn, its ability to exert market power. Clearly, the same holds for Instagram, albeit to a lesser extent. This would explain why both Facebook and Instagram advertising revenues increased pronouncedly more than any other competitor.

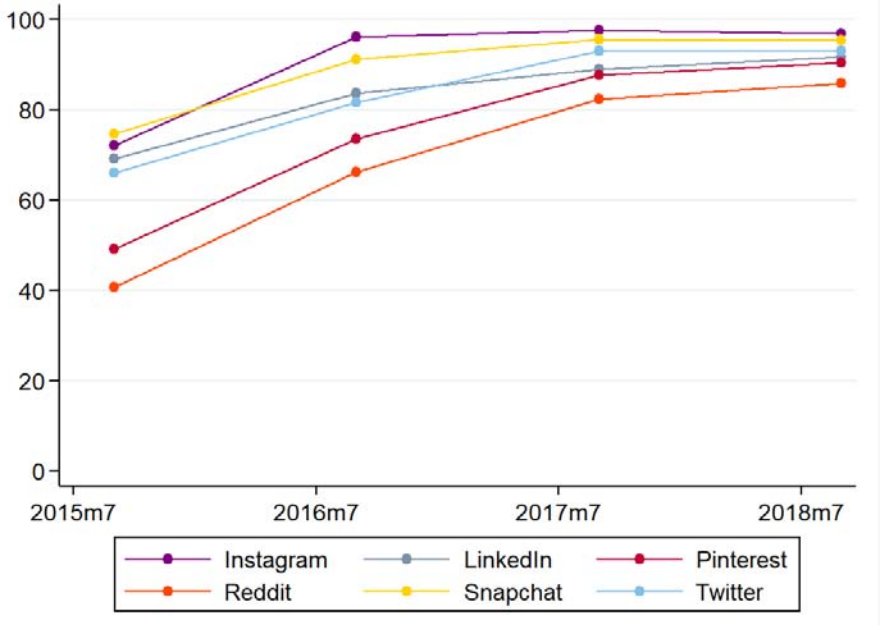
[34] Note that the available data only allows to measure overlapping users across pairs of social networks. However, the percentage of social network users who is cross-visiting a second platform, may also cross-visit an additional third platform.

Figure 9: Percentage of Facebook's users that visits the main social networks



Source: authors based on ComScore data

Figure 10: Percentage of other platforms' users that visits Facebook in the UK



Source: authors based on ComScore data

Conclusions on Facebook/Instagram

The above analysis shows a number of gaps in the Authorities' assessment of the *Facebook/Instagram* merger. However, the most relevant would seem to be the failure to frame the analysis in a two-sided setting. The two (or more) sides of the market should be looked at jointly, as choices made by the platform on the various sides are interdependent. However, the Authorities focussed their attention on the users' side, placing excessive weight on the functionality offered by the parties' products to users', and somewhat overshadowing other sides of the market. Relatedly, the Authorities might have neglected some factors that drive advertisers' choices: chief among these are exclusivity of the user base, size of the user base, and accuracy in targeting. The assessment of the market structure which has arisen after the merger shows that the acquisition of Instagram has provided a competitive advantage to the merged entity across all of these three dimensions, which has resulted in unmatched growth in terms of users and advertising revenues.

Assessing whether this could be interpreted as a welfare loss and one that was caused by the Authorities' decision to clear the merger requires (i) identifying what would have occurred to Instagram in the absence of the merger, i.e. the counterfactual scenario, and (ii) balancing the harmful effects of potential lower competition and the benefits of efficiencies realized thanks to the merger. Neither is an easy task.

Two alternative counterfactuals to the clearance can be identified:

- Instagram would have become a popular social network and Facebook would have faced a strong competitor in the social network market. The example of Snapchat suggests that it may have been possible for Instagram to continue its growth without help from Facebook;
- Instagram would not have been able to grow further and monetize its user base. Instagram would have struggled to expand its functionalities without Facebook's guidance and its growth would have stalled in absence of the infrastructure needed to manage a growing user base.

In both counterfactual scenarios, Facebook may have encountered some difficulties into targeting the youngest users, and competing with the emerging mobile-first platforms, such as Snapchat.

Compared to a counterfactual scenario where Instagram would still have become a popular social network, the merger has increased Facebook ability to exert market power, by eliminating a viable and strong competitor in the market for social networks. Compared to a counterfactual scenario where Instagram would have not been able to grow as a social network, the merger may still have provided Facebook the means to consolidate and strengthen a competitive advantage.

Compared to both counterfactuals, the merger has generated efficiencies. Being able to monitor consumer behaviour on its platform and on Instagram, Facebook can effectively target advertising and reduce inefficient ads duplications on its platforms. On the one hand, this has fostered the competitive advantage of Facebook and Instagram. Advertisers seem to prefer Facebook and Instagram, and pay a premium for their services, because of, among other factors, their ability to reach nearly all users contracting with a single entity and control the number of ad impressions. On the other hand, this may have generated benefits to consumers, who generally perceive advertising

as a nuisance. Such efficiencies are merger-specific: they would not have arisen in the absence of the *Facebook/Instagram* merger, or in case Instagram had been acquired by an entity different from a social network.

In conclusion, the effect of the Authorities' decision to clear the merger on consumer welfare depend on the balance between likely anticompetitive effects and efficiencies, which in turn heavily depend on the selected counterfactual. There are no elements to identify which counterfactual would have been more likely. Stronger anticompetitive effects are expected in the case where Instagram would have become a viable competitor alone or if acquired by a third party: in this case, efficiencies would need to be high enough to compensate for the loss of competition. However, data suggests that Snapchat has not been able to monetize engagement to the extent that Instagram did, which is perhaps the signal that Facebook's role in the development of Instagram with respect to advertising was significant.

4.2 Google/Waze

On November 11, 2013, the OFT cleared Google's acquisition of Waze.[35] At that time, Google operated an Internet search engine and sold advertising space on its websites and on partner websites. Moreover, it offered Google Maps, a free application providing mapping and turn-by-turn navigation services. Waze provided another turn-by-turn navigation app that was only available on mobile devices.

Assessment of ToHs

The Authorities investigated two main ToHs.

Loss of potential competition. First, the transaction could significantly affect competition in the market for mobile turn-by-turn navigation applications, with the result of reducing the parties' incentives to innovate and thus the quality of the service offered to users. This ToH was dismissed because Waze had not reached a user base in the UK that was considered sufficient to build a map with coverage and accuracy comparable to Google's. Moreover, the existence of other turn-by-turn navigation apps – most notably Apple Maps – was found to exert relatively stronger constraints on Google.

The Authorities may have over-relied on the competitive constraint that Apple Maps would have exerted on the merged entity. Apple Maps was only available on iOS devices, which represented 30-31% of smartphone sales in the UK at the time of the merger and could represent an indirect constraint on Google Maps for Android devices only to the extent that Google cannot discriminate

[35] Office of Fair Trading Decision of 11 November 2013 in Case ME/6167/13 – Motorola Mobility Holding (Google, Inc.) / Waze Mobile Limited.

between the two OSs. If Google were to lower the quality of Google Maps on Android, for instance by introducing ads –which, being generally considered as a nuisance, would represent a drop in quality–, Android users would not be able to switch to Apple Maps. The Authorities could have investigated whether such discrimination was feasible.

Loss of innovation. Second, the Authorities were concerned that Waze could represent a disruptive force in the market going forward and that the removal of future rivalry between the parties caused by the merger could dampen Google's incentives to innovate and improve product quality. The Authorities dismissed this ToH because of the uncertainty in Waze's future growth projections. The scale reached by Waze in the UK was not sufficient for it to benefit from significant network effects that could accelerate its growth. Moreover, there was uncertainty with respect to the effect of the partnerships that Waze was finalizing. In any case, there would have remained other strong competitors in the market.

Regarding Waze's potential, there were signals that Waze had identified a promising path to growth. While lagging significantly behind Google Maps, Waze was among the most popular navigation apps among Android and iOS users. The evidence collected by the Authorities with respect to past growth and the opinions of third parties as well as of the merging parties themselves clearly signaled that there was significant potential to Waze, as did the greater success that Waze had reached in other countries at the time of the merger.

Waze's business model, based on crowdsourcing of most information needed to feed the app, was also a relevant factor pointing to possible future growth. Indeed, crowdsourcing of information not only decreases entry costs by providing a cost-effective alternative to purchasing maps information from third parties; it also makes improvements to the app, in terms of maps accuracy and reliability of live traffic information, relatively less costly to implement.

As explained in Section 3, the installed user base can constitute a source of competitive advantage. This was the case for Waze, which the Authorities referred to as first-mover advantage. Third parties consulted by the Authorities expressed concerns that it would have been difficult for an entrant to replicate the success achieved by Waze with an equivalent model. The OFT just considered that crowdsourcing was not unique to Waze, but it did not assess the likelihood with which other operators could have successfully achieved a critical mass.

Relatedly, the OFT somewhat misinterpreted the role played by network effects in this market. Specifically, they did not "consider that, on the basis of the evidence, Waze had achieved sufficient scale in the UK to the extent that it was benefitting from significant and insuperable network effects, or that this would lead to an acceleration in its future growth."[36] However, the relevant

[36] Office of Fair Trading Decision of 11 November 2013 in Case ME/6167/13, § 49.

question was not whether Waze already enjoyed insuperable network effects, but rather whether network effects could play a role in accelerating growth. Indeed, Waze had found a way to leverage its existing customer base: the larger such base, the more contributions to the quality of the maps and of the service in general; since better quality attracts more users, a positive feedback loop is created.

Overall, there may have been enough evidence for the Authorities to conclude that Waze could have become a relevant competitive force.

Most importantly, the range of ToHs analyzed in the decision was incomplete. ToHs developed by the Authorities focused solely on the effect that the merger could have had on the users' side of the market. However, turn-by-turn navigation apps are provided to users for free and are monetized elsewhere. The Authorities should have explored monetization channels and evaluate whether the merger could have had an adverse effect in the markets where monetization occurs.

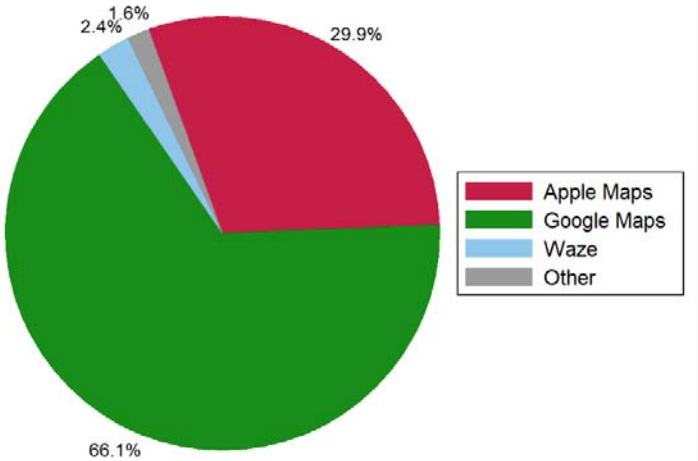
Assessment of post-merger market outcomes

Google and Waze both provide turn-by-turn navigation services, which are however fundamentally different in terms of their characteristics. Unlike Google Maps, the Waze map is user-generated and the app is mainly used by heavy drivers. By exploiting their complementarities, the merger between Google and Waze allowed the merging parties to share data and information, reduce the costs of entering new geographic areas and avoid certain cost duplications. Moreover, efficiencies that resulted in the improvement of Google Maps were realized to the benefit of all Google Maps users. Google Maps' high market penetration means that a large number of users have benefitted from them, making efficiencies quite significant.

Since 2012, the number of Waze's active users has increased. In the years after the merger, Waze still represented one of the main alternatives to Google Maps for the provision of turn-by-turn navigation services, together with Apple Maps. Figure 11 shows the share of the various apps in the supply of turn-by-turn navigation apps, in terms of unique users, at the beginning of 2015 in the UK (the earliest date for which data is available after the merger took place).[37] While substantially smaller than Google Maps and Apple Maps, Waze is the third app for number of unique users.

[37] The shares are calculated based on the number of unique users in January 2015 provided by ComScore, which collects data only for navigation applications whose number of users is above a threshold ("Minimum Reporting Standard"). We do not expect results to be significantly different if those apps were instead included in the analysis. The Minimum Reporting Standard was equal to 149,000 unique users in January 2015.

Figure 11: Share of supply in turn-by-turn navigation apps, 2015m1 (% of unique users)



Source: authors based on ComScore data

At the time of its decision, the OFT relied on the fact that there were other providers of turn-by-turn navigation apps, different from Waze, that would continue to represent strong competitive constraints on Google Maps, particularly Apple Maps. The evidence collected shows that after the merger Google has remained the main provider of turn-by-turn navigation services, with a share of 66%, followed by Apple Maps (30% share) and Waze (2% share).

Few of the existing competitors seem to rely on crowd-sourced data and they attract very few users. This may be consistent with Waze's first mover advantage and with the concerns expressed by third parties that it would have been difficult for an entrant to replicate the success achieved by Waze with a similar model.

It should also be noted that Apple Maps continues to be available only on iOS devices, which may limit the extent to which it provides a competitive constraint on the merged entity.

Conclusions on Google/Waze

The Authorities' investigation at the time of the merger uncovered that Waze was a promising application in a market where users did not have many alternatives, with a promising business model and growth strategy. Yet, the Authorities were very – perhaps too much – cautious in the assessment of the evidence before them dismissing the potential competition ToH in part due to uncertainty in future market developments. Further, the reliance on Apple Maps as a source of competitive constraint on the merged entity may have been overstated.

Most importantly, however, the Authorities did not explore the effects of the merger on several economic activities related to the provision of turn-by-turn navigation services, which represent the way these services are monetized. Understanding monetization avenues should represent an

unavoidable step for the development of a ToH because, quite simply, market power is not exerted for its own sake, but has the ultimate objective of increasing profits. Investigating the monetization strategy is important because it can uncover additional, potentially anti-competitive effects of the merger. Moreover, it can shed light on the rationale of the merger from the parties' perspective, as it will make clear how the target brings value (that is, profits) to the acquirer.

Again, understanding whether the merger has ultimately led to welfare loss requires (i) identifying the counterfactual scenario, and (ii) balancing the harmful effects of potential lower competition and the benefits of efficiencies realized thanks to the merger.

Different counterfactual scenarios can be envisaged:

- Waze could have grown over time, attracted more users and in turn improved its services and the accuracy of its maps;
- Waze could have grown by gaining access to the financial resources of other digital companies interested in its innovative technology;
- Waze could have been acquired by another turn-by-turn navigation service provider such as Apple Maps;
- Waze could have gradually disappeared from the market.

There are few elements that allow to identify the most likely counterfactual. Whilst other large digital incumbents approached Waze, it seems that they all elected not to acquire it, making the counterfactual represented by alternative transactions somewhat less likely. Most of these tentative acquisitions, however, were contemporaneous to the acquisition by Google, and this may have discouraged alternative buyers.

Waze proved to have a very innovative technology, and Google itself labelled it as a "brand worth tracking." This may have allowed it to grow, even in the absence of an alternative buyers. However, while reliance on crowd sourcing enabled Waze to supply accurate and valuable real time traffic information, it may have had some limit when coming to maps' accuracy or coverage.

Finally, the merger has enabled Google Maps and Waze to exploit their complementarities and generate efficiencies. These efficiencies are clearly merger-specific and should be taken into account when assessing whether the decision has proved to be beneficial or detrimental to consumers.

5. Conclusions and Recommendations

In this paper we provide a comprehensive evaluation of past merger decisions taken by the UK Authorities affecting multisided digital platforms. After giving a brief overview of the acquisitions carried out by three major digital platforms –Google, Amazon, and Facebook–, we discuss key features of such markets that create new challenges for competition policy as well as the ToHs that have been or could be used to address these features. We then look at two landmark cases – Facebook/Instagram and Google/Waze – to carefully assess the authorities' decisions. On the one hand, our retrospective evaluation adopts a traditional *ex-post* perspective, in which we study how

the merger and the decision might have influenced the evolution of the affected markets. On the other hand, we also perform a more novel assessment, where we review whether the analysis performed by the authorities at the time of the merger and the adopted ToHs were sufficient given what we now know. Indeed, a complete and effective *ex-post* assessment should not only study what are the potential consequences of a merger decisions, but also whether the arguments underpinning these decisions were appropriate.

Our evaluation reveals certain gaps in the way these cases were analyzed, despite the depth of the analyses carried out. Such gaps do not undermine the legitimacy of the Authorities' decisions and can be properly perceived today thanks to a better understanding of how digital markets work and the actual behavior of some market players that was highly uncertain at the time the mergers were investigated. Yet, we share the concern voiced by others that merger control enforcement has not proved able so far to cope with several of the new challenges posed by digital markets. More can and should be done. It might be that this will require a change in the legislation or the establishment of a new regulator. We do not opine on this. However, we think that before undertaking such a complex and uncertain endeavor, competition authorities need to check whether more can be achieved within the existing legal framework. Therefore, we offer a few suggestions as our concluding remarks.

- Network effects often make the structure of digital markets quite concentrated and barriers to entry rather high, making competition *for* the market the main mechanism left to discipline incumbents and potential competitors particularly valuable. Thus, the social costs of an incorrect clearance may be higher in digital markets than they are in traditional markets, which may justify a different, perhaps more interventionist, approach to digital markets.
- CAs may benefit from a better understanding of the markets for online advertising. These markets are particularly important, as they represent the way many digital services are monetized, yet the competitive dynamics prevailing therein are not well understood. A comprehensive market study into the digital advertising sector – such as the inquiry that the CMA started in the summer of 2019 – could be a good instrument to gain the necessary knowledge for future enforcement activity in these markets.[38]
- CAs have not always consistently framed the competition issues they were looking at in a multi-sided setting, focusing their attention on the users' side of the market, somewhat overshadowing the other sides. All sides of a market need to be looked at jointly, as choices made by the platform on them are interdependent.

[38] The interim report with some preliminary findings has been published at the End of 2019. See https://www.gov.uk/cma-cases/online-platforms-and-digital-advertising-market-study#interim-report.

- Current business models and monetization avenues should represent an unavoidable step for the development of a ToH because market power is not exerted for its own sake, but has the ultimate objective of increasing profits. Investigating the monetization strategy is also important because it can shed light on the rationale of the merger from the parties' perspective, making clear how the target brings value – that is, profits – to the acquirer.
- The time frame of two years, which represents the default for the assessment of some future market developments, such as entry, within merger investigations in many jurisdictions, may be somewhat limiting and could be extended when dealing with mergers in digital markets: even in the fast-moving digital landscape, becoming successful can take longer than two years.
- There is a large number of transactions being undertaken by digital incumbents. The value of the transaction may help CAs screen among those transactions to identify those that may warrant a more in-depth analysis of the merger, since it represents the magnitude of the effects (both beneficial and detrimental) associated to the transaction.
- Defining the counterfactual to a merger is always complex but may be especially so when one of the merging parties is a very young firm in the early stage of its development. Yet, predicting evolution is essential to understand whether the transaction will harm competition. Predicting evolution may benefit from improving the information gathering powers of CAs, for instance by using dawn raids in the context of merger investigations.
- CAs would need to be willing to accept more uncertainty in their counterfactual. Even after reinforcing the tools available, there will always be a certain degree of uncertainty as to the counterfactual chosen for the assessment of a merger. Future plans, no matter how carefully set out, are always subject to being unmade by unforeseen market events.
- A more speculative counterfactual may result in falling short of the meeting the legal tests CAs are required to satisfy to block a merger. However, as high tech markets evolve and pose new challenges, for CAs to be effective in the enforcement of merger policy, it may be necessary to test, and possibly adapt, the boundaries of the substantive rules and of the applicable standard of proof.

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Appendix: list of past transactions

Table A.1: List of acquisitions made by Amazon

Name of target	Cluster	Sub-cluster
2lemetry	Tools for developers	
AbeBooks	Physical goods and services	Retail
Amie Street	Digital content	Video/Music
Annapurna Labs	Remote storage and file transfer	
AppThwack	Physical goods and services	Robotics
Audible.com	Digital content	E-books/News
Avalon Books	Physical goods and services	Other
Biba Systems	Communication apps and tools	Email and office communication
Blink Home	Physical goods and services	Electronic devices and components
Body Labs	Artificial intelligence, data science and analytics	Artificial Intelligence
Box Office Mojo	Other	
BuyVIP	Physical goods and services	Retail
Cloud9 IDE	Tools for developers	
ClusterK	Remote storage and file transfer	
comiXology	Digital content	E-books/News
Curse, Inc.	Digital content	Games
Do.com	Communication apps and tools	Email and office communication
Double Helix Games	Digital content	Games
Elemental Technologies	Remote storage and file transfer	
Emvantage Payments Pvt. Ltd.	Other	
Evi	Artificial intelligence, data science and analytics	Artificial Intelligence
Fabric.com	Physical goods and services	Retail
GameSparks	Tools for developers	
Goo Technologies	Other	
Goodreads	Communication apps and tools	Topic specific platform
Graphiq	Artificial intelligence, data science and analytics	Data science and analytics
Harvest.ai	Artificial intelligence, data science and analytics	Artificial Intelligence
IVONA Software	Artificial intelligence, data science and analytics	Artificial Intelligence
Kiva Systems	Physical goods and services	Robotics
Lexcycle	Digital content	E-books/News
Liquavista	Physical goods and services	Electronic devices and components
LoveFilm	Physical goods and services	Retail
More	Physical goods and services	Retail
NICE	Remote storage and file transfer	
OpenSCG	Remote storage and file transfer	
PillPack	Home, wellbeing and other personal needs	
Pushbutton	Digital content	Video/Music
Quidsi	Physical goods and services	Retail
Reflexive Entertainment	Digital content	Games
Ring	Physical goods and services	Electronic devices and components

Safaba Translation Systems	Artificial intelligence, data science and analytics	Artificial Intelligence
Shelfari	Communication apps and tools	Topic specific platform
Shoefitr	Home, wellbeing and other personal needs	
SnapTell	Artificial intelligence, data science and analytics	Artificial Intelligence
Souq.com	Physical goods and services	Retail
Sqrrl	Artificial intelligence, data science and analytics	Data science and analytics
Stanza	Digital content	E-books/News
Tapzo	Home, wellbeing and other personal needs	
Teachstreet	Home, wellbeing and other personal needs	
TenMarks Education, Inc.	Home, wellbeing and other personal needs	
The Book Depository	Physical goods and services	Retail
Thinkbox Software	Tools for developers	
Toby Press	Physical goods and services	Other
Touchco	Other	
Twitch	Communication apps and tools	Topic specific platform
Whole Foods Market	Physical goods and services	Retail
Wing.ae	Physical goods and services	Retail
Woot	Physical goods and services	Retail
Yap	Artificial intelligence, data science and analytics	Artificial Intelligence
Zappos	Physical goods and services	Retail

Source: authors based on Crunchbase data

Table A.2: List of acquisitions made by Facebook

Name of target	Cluster	Sub-cluster
Acrylic Software	Other	
Ascenta	Physical goods and services	Robotics
Atlas solutions	Advertising tools and platforms	
BELUGA	Communication apps and tools	Direct messaging and calls
Bloomsbury AI	Artificial intelligence, data science and analytics	Artificial Intelligence
Branch	Communication apps and tools	Direct messaging and calls
Caffeinatedmind	Remote storage and file transfer	
Chai Labs	Artificial intelligence, data science and analytics	Artificial Intelligence
Confirm	Artificial intelligence, data science and analytics	Artificial Intelligence
ConnectU	Other	
CrowdTangle	Artificial intelligence, data science and analytics	Data science and analytics
DayTum	Home, wellbeing and other personal needs	
Divvyshot	Communication apps and tools	Photo apps

Drop.io	Remote storage and file transfer	
Face.com	Artificial intelligence, data science and analytics	Artificial Intelligence
Faciometrics	Artificial intelligence, data science and analytics	Artificial Intelligence
Fayteq	Other	
FB.com domain name	Other	
Friend.ly	Communication apps and tools	Other
FriendFeed	Communication apps and tools	Aggregators
Friendster	Communication apps and tools	Topic specific platform
Glancee	Communication apps and tools	Other
Gowalla	Communication apps and tools	Topic specific platform
Hot Potato	Communication apps and tools	Topic specific platform
Hot Studio	Tools for developers	
Infiniled	Physical goods and services	Electronic devices and components
Instagram	Communication apps and tools	Photo apps
Jibbigo	Artificial intelligence, data science and analytics	Artificial Intelligence
Karma	Home, wellbeing and other personal needs	
Lightbox.com	Communication apps and tools	Photo apps
Little Eye Labs	Tools for developers	
Liverail	Advertising tools and platforms	
MailRank	Communication apps and tools	Email and office communication
Masquerade	Communication apps and tools	Other
Monoidics	Artificial intelligence, data science and analytics	Artificial Intelligence
Nascent Objects	Physical goods and services	Electronic devices and components
Nextstop	Communication apps and tools	Topic specific platform
Octazen	Communication apps and tools	Other
Oculus VR	Physical goods and services	Other
Onavo	Artificial intelligence, data science and analytics	Data science and analytics
Osmeta	Other	
Ozlo	Artificial intelligence, data science and analytics	Artificial Intelligence
Parse	Tools for developers	
Pebbles	Tools for developers	
PrivateCore	Remote storage and file transfer	
ProtoGeo Oy	Home, wellbeing and other personal needs	
Pryte	Home, wellbeing and other personal needs	
Push Pop Press	Digital content	E-books/News
Quickfire	Remote storage and file transfer	
RecRec	Tools for developers	
Redkix	Communication apps and tools	Email and office communication
Refdash	Other	
Rel8tion	Advertising tools and platforms	
ShareGrove	Communication apps and tools	Direct messaging and calls
snaptu	Tools for developers	
Sofa	Tools for developers	
Spaceport	Tools for developers	

Spool	Home, wellbeing and other personal needs	
SportStream	Artificial intelligence, data science and analytics	Data science and analytics
Strobe	Tools for developers	
Surreal Vision	Physical goods and services	Robotics
Tagtile	Advertising tools and platforms	
tbh(app)	Communication apps and tools	Other
TheFind	Physical goods and services	Retail
Threadsy	Communication apps and tools	Aggregators
Two Big Ears	Physical goods and services	Electronic devices and components
Vidpresso	Communication apps and tools	Other
WaveGroup Sound	Digital content	Video/Music
WhatsApp	Communication apps and tools	Direct messaging and calls
Wit.ai	Tools for developers	
Zurich eye	Tools for developers	

Source: authors based on Crunchbase data

Table A.3: List of acquisitions made by Google

Name of target	Cluster	Sub-cluster
60db	Digital content	E-books/News
Aardvark	Communication apps and tools	Other
Admeld	Advertising tools and platforms	
AdMob	Advertising tools and platforms	
Adometry	Advertising tools and platforms	
Agawi	Digital content	Video/Music
Agnilux	Physical goods and services	Electronic devices and components
AIMatter	Artificial intelligence, data science and analytics	Artificial Intelligence
Alpental Technologies	Physical goods and services	Electronic devices and components
Angstro	Communication apps and tools	Aggregators
Anvato	Tools for developers	
API.AI	Artificial intelligence, data science and analytics	Artificial Intelligence
Apigee	Tools for developers	
AppBridge	Remote storage and file transfer	
Appetas	Other	
AppJet	Tools for developers	
Appurify	Tools for developers	
Apture	Home, wellbeing and other personal needs	
Autofuss	Advertising tools and platforms	
BandPage	Communication apps and tools	Topic specific platform
BeatThatQuote.com	Physical goods and services	Retail
bebop	Remote storage and file transfer	
Behavio	Artificial intelligence, data science and analytics	Artificial Intelligence
Bitium	Remote storage and file transfer	
Bitspin	Home, wellbeing and other personal needs	
BlindType	Home, wellbeing and other personal needs	

Bot & Dolly	Physical goods and services	Robotics
BufferBox	Physical goods and services	Retail
Bump	Tools for developers	
BumpTop	Home, wellbeing and other personal needs	
Cask	Tools for developers	
Channel Intelligence	Physical goods and services	Retail
Clever Sense	Home, wellbeing and other personal needs	
Cronologics	Physical goods and services	Electronic devices and components
DailyDeal	Physical goods and services	Retail
Dark Blue Labs & Vision Factory	Artificial intelligence, data science and analytics	Artificial Intelligence
Dealmap	Physical goods and services	Retail
DeepMind Technologies	Artificial intelligence, data science and analytics	Data science and analytics
Digisfera	Other	
Director	Advertising tools and platforms	
Divide	Home, wellbeing and other personal needs	
DNNresearch Inc.	Artificial intelligence, data science and analytics	Artificial Intelligence
DocVerse	Other	
drawElements	Tools for developers	
Dropcam	Physical goods and services	Electronic devices and components
eBook Technologies	Other	
Emu	Communication apps and tools	Email and office communication
Episodic	Digital content	Video/Music
Eyefluence	Physical goods and services	Other
Fabric	Tools for developers	
FameBit	Advertising tools and platforms	
Firebase	Tools for developers	
FlexyCore	Tools for developers	
Flutter	Artificial intelligence, data science and analytics	Artificial Intelligence
Fly Labs	Other	
Fridge	Communication apps and tools	Direct messaging and calls
Gecko Design	Other	
Gizmo5	Communication apps and tools	Direct messaging and calls
Global IP Solutions	Communication apps and tools	Direct messaging and calls
GraphicsFuzz	Tools for developers	
Green Parrot Pictures	Other	
GreenThrottle	Digital content	Games
Halli Labs	Artificial intelligence, data science and analytics	Artificial Intelligence
Holomni	Physical goods and services	Robotics
HTC (portions)	Physical goods and services	Electronic devices and components
Impermium	Other	
Incentive Targeting Inc.	Advertising tools and platforms	
Industrial Perception	Artificial intelligence, data science and analytics	Artificial Intelligence
Instantiations	Tools for developers	
Invite Media	Advertising tools and platforms	

Jambool	Other	
Jetpac	Communication apps and tools	Photo apps
Jibe Mobile	Communication apps and tools	Direct messaging and calls
Kaggle	Artificial intelligence, data science and analytics	Data science and analytics
Katango	Communication apps and tools	Other
Kifi	Artificial intelligence, data science and analytics	Data science and analytics
LabPixies	Other	
LaunchKit	Tools for developers	
Launchpad Toys	Home, wellbeing and other personal needs	
LeapDroid	Tools for developers	
Lift Labs	Physical goods and services	Electronic devices and components
Like.com	Artificial intelligence, data science and analytics	Artificial Intelligence
Limes Audio	Communication apps and tools	Direct messaging and calls
Makani Power	Physical goods and services	Other
mDialog	Advertising tools and platforms	
Meebo	Communication apps and tools	Direct messaging and calls
Meka Robotics	Physical goods and services	Robotics
Metaweb	Other	
Milk, Inc	Tools for developers	
Moodstocks	Tools for developers	
Motorola Mobility	Physical goods and services	Electronic devices and components
MyEnergy	Home, wellbeing and other personal needs	
Nest Labs	Home, wellbeing and other personal needs	
Next New Networks	Digital content	Video/Music
Nik Software, Inc.	Other	
Odysee	Communication apps and tools	Photo apps
Omnisio	Communication apps and tools	Other
On2	Tools for developers	
Onward	Artificial intelligence, data science and analytics	Artificial Intelligence
Orbitera	Physical goods and services	Retail
Owlchemy Labs	Digital content	Games
Oyster	Digital content	E-books/News
Phonetic Arts	Artificial intelligence, data science and analytics	Artificial Intelligence
Picnik	Communication apps and tools	Photo apps
Pie	Communication apps and tools	Email and office communication
PittPatt	Artificial intelligence, data science and analytics	Artificial Intelligence
Pixate	Tools for developers	
Plannr	Communication apps and tools	Email and office communication
PlinkArt	Artificial intelligence, data science and analytics	
Polar	Communication apps and tools	Other
Pulse.io	Tools for developers	
Punchd	Physical goods and services	Retail
PushLife	Remote storage and file transfer	

Quest Visual	Artificial intelligence, data science and analytics	Artificial Intelligence
Quickoffice	Other	
Quiksee	Other	
Qwiklabs	Tools for developers	
Rangespan	Artificial intelligence, data science and analytics	Data science and analytics
reCAPTCHA	Artificial intelligence, data science and analytics	Artificial Intelligence
Red Hot Labs	Advertising tools and platforms	
Redwood Robotics	Physical goods and services	Robotics
RelativeWave	Tools for developers	
Relay Media	Tools for developers	
reMail	Communication apps and tools	Email and office communication
Revolv	Home, wellbeing and other personal needs	
RightsFlow	Other	
Ruba.com	Home, wellbeing and other personal needs	
SageTV	Digital content	Video/Music
SayNow	Communication apps and tools	Direct messaging and calls
SCHAFT, Inc.	Physical goods and services	Robotics
Senosis	Home, wellbeing and other personal needs	
Simplify Media	Remote storage and file transfer	
Skillman & Hackett	Tools for developers	
Skybox Imaging	Artificial intelligence, data science and analytics	Data science and analytics
SlickLogin	Other	
Slide.com	Communication apps and tools	Other
SocialDeck, Inc.	Advertising tools and platforms	
SocialGrapple	Artificial intelligence, data science and analytics	Data science and analytics
Softcard	Other	
Songza	Digital content	Video/Music
Sparrow	Communication apps and tools	Email and office communication
spider.io	Other	
Stackdriver	Remote storage and file transfer	
Synergyse	Other	
Talaria Technologies	Tools for developers	
Tenor	Communication apps and tools	Other
Teracent	Advertising tools and platforms	
Thrive Audio	Tools for developers	
Timeful	Home, wellbeing and other personal needs	
Titan Aerospace	Physical goods and services	Robotics
TNC	Communication apps and tools	Topic specific platform
TxVia	Other	
Urban Engines	Artificial intelligence, data science and analytics	Data science and analytics
Velostrata	Remote storage and file transfer	
Vidmaker	Other	

Viewdle	Artificial intelligence, data science and analytics	Artificial Intelligence
VirusTotal.com	Other	
Wavii	Digital content	E-books/News
Waze	Home, wellbeing and other personal needs	
Webpass	Physical goods and services	Other
Widevine Technologies	Other	
Wildfire Interactive	Advertising tools and platforms	
WIMM Labs	Physical goods and services	Electronic devices and components
Zagat	Home, wellbeing and other personal needs	
Zave Networks	Physical goods and services	Retail
Zetawire	Other	
Zynamics	Other	
Zync Render	Other	

Source: authors based on Crunchbase data