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Original Article

Platform mergers and antitrust

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Abstract

Should internet era merger policy differ from industrial era merger policy? Platform ecosystems rely on economies of scale, data-driven economies of scope, high-quality algorithmic systems, and strong network effects that frequently promote winner-take-most markets. Their market dominance has generated competition concerns that appear difficult to assess with traditional merger policy tools. This paper examines the acquisition strategies of the five major U.S. platforms—Google, Amazon, Facebook, Apple, and Microsoft—since their inception. We discuss the main merger and acquisition theories of harm and how these operate differently than in the past. To address merger and acquisition concerns of multi-sided platforms, we develop four proposals that incorporate (i) a new ex ante regulatory framework, (ii) an update of the conditions under which the notification of mergers should be compulsory and the burden of proof should be reversed, (iii) differential regulatory priorities in investigating horizontal versus vertical acquisitions, and (iv) an update of competition enforcement tools to increase visibility into market data and trends.

JEL classification: D20, K21, L40, L41, L42, L43, L51, L86, M13, M21

1. Introduction

Merger activity can be anticompetitive. It can also enhance efficiency. We explore this simultaneous problem and opportunity for platform firms and their digital ecosystems. Platforms have become increasingly dominant in the global economy and, as a result, are drawing significant regulatory scrutiny. Our goal is to catalog the magnitude of platform merger and acquisition (M&A) activity for the largest platforms, describe their varying motives, explore the potential for harm, and put forth a set of proposals that might reduce such harm. These proposals are designed to (i) improve the flow of information that creates value, (ii) adjust the notification threshold and the burden of proof in merger cases, (iii) better assess the dynamic effects of mergers, and (iv) suggest updates to merger policy tools.

Firms have many motives for engaging in M&A activity (Puranam, 2015). These include accessing specialized workers, technology, products, or new channels of distribution; building a critical mass of operations to realize economies of scale and scope; and shaping market conditions to be less affected by competitive forces. With these assets, they can grow larger within their core business, expand horizontally into adjacent markets, or expand vertically into the producer or consumer role. Whatever the reason, one common underlying theme behind each M&A is quick access to and control over sets of resources.

Put differently, M&As generate value for the merged entities that stem from internal reorganization as well as reshaping the market. Whether they generate value beyond the merged firms, for consumers and society, largely depends on consequences of the merger for market structure and competition.

A major M&A concern is market power failure. Does the increase in market power through M&A generate private benefit to the detriment of society? This paper deals with M&A strategies of digital platforms and proposes a set of policy interventions to maximize their social value.

Assessing the welfare implications of platform M&A requires understanding the unique strategic dynamics of digital ecosystems. Two divergent economic features—structure and resources—are salient. Structurally, platforms operate multi-sided markets that differ from vertically integrated or "pipeline" firms. This distinction is clearer in the characterization of platforms as "inverted firms" in which a disproportionate share of value is created outside the firm by third parties rather than inside the firm itself (Parker *et al.*, 2017). Much value is orchestrated rather than created. This holds true for operating systems, web search, e-commerce markets, and social networks. Platforms are de facto matchmakers for the markets in which they operate. If, through M&A or through in-house development, they enter a market niche they serve, they wield unique power to match consumers with themselves rather than with alternate suppliers. This structure differs from that of two independent vertically integrated suppliers, creating their own value and operating in a market that neither one controls.

Further, in order to orchestrate, platforms adopt and enforce governance rules over the access and behavior of producers and consumers using their infrastructure as well as dispute resolution mechanisms when these rules are challenged by market participants. By controlling governance, platforms can reshape a market's rules to its benefit, at the expense of other participants when private and social incentives for market conduct diverge. The crucial question then becomes whether and when acquisitions of other companies (or other platforms) generate such incentives.

Understanding the second divergent feature requires distinguishing tangible from intangible assets. If the primary resource is tangible, then dividing asset ownership generally solves competition problems. If one firm has acquired all cotton fields or all diamond mines, then splitting those assets can create competition, increase supply, reduce price, and raise welfare. This is not so for intangible assets, especially data. Because information is nonrival, two or more parties can simultaneously share the asset as an input to production. This implies that M&A policies that seek to partition the asset or restrict use of information can reduce value created from information. Laws to regulate tangible assets do not stretch easily to regulate intangible assets.

Multi-sided platforms exhibit an unprecedented ability to capture data from interactions taking place on the platform. Technological progress in artificial intelligence and machine learning has allowed them to translate this information into personalization as well as new or improved services, more tailored user offerings, and better matched interactions with other users of the ecosystem. Data aggregation gives rise to economies of scope (Martens, 2020): merging two complementary datasets can generate more insight and economic value than keeping them in separate data silos. Because complementary and orthogonal data dimensions can offer more insight than independent data analyses, merged data analysis can be more productive, especially when the marginal cost of applying analytics to more complex data is small. Indeed, information exhibits significant *economies of scale*. Digital goods and services are typically produced at a significant fixed cost but no or little variable cost (Varian *et al.*, 2004). In other words, the cost of production is much less than proportional to the number of customers served. Hence, once merged, big digital firms can grow quickly by expanding their operations to new users or adjacent markets at minimum cost.

Mergers can intensify data-driven *economies of scope*, valuable to multi-sided platforms, because they also facilitate strategies of horizontal and vertical platform expansion. Through mergers, platforms can repurpose insights from data they have collected to operate in adjacent horizontal markets. In addition, platforms can use data to identify vertical expansion opportunities and compete directly with upstream producers that operate on their infrastructure. The platform's operating data, spanning all its market players, provides a privileged view superior to that of any individual producer. Mobile operating system platforms, for example, have used such data to enter lucrative upstream applications such as music streaming, mapping, news provision,

and fitness.[1] Private knowledge of an operating system's internal technical features can privilege apps developed by the platform relative to those developed by outsiders (Cabral *et al.*, 2021). Amazon frequently enters the markets of its suppliers (Zhu and Liu, 2018; Zhu, 2019). When trying to assess the social value of mergers, the role of data and whether it can contribute to successive monopolies that gradually expand to new markets by eliminating competition must be carefully examined.

Lastly, any proper welfare analysis must account for *network effects*, which are particularly salient among multi-sided platforms. Network effects cause a user's value from participating on a platform to rise with the participation of other users (Parker and Van Alstyne, 2000, 2005). If so, mergers can generate additional value through strengthening and expanding such network effects. To illustrate, consider Metcalfe's Law whereby a network of size N grows in value proportional to $O(N^2)$. This implies that a merger of two independent networks of sizes N and M, with independent values $O(N^2)$ and $O(M^2)$, have a combined value proportional to $(N+M)^2$, which has a total size of $N^2+2NM+M^2$. Thus, the merger creates a difference of $O(\mathrm{N}^2+2\,NM+M^2)$ – $O(N^2)$ – $O(M^2)$ of value. Unraveling such a merger implies foregoing this much value addition. In contrast to industrial markets, remedies such as breakup may be unwise in online markets.

These three forces—economies of scope, economies of scale, and network effects that are born of structural and resource differences—frequently lead to first-mover advantage. Super platforms, or platforms of platforms, are one consequence. Mergers and acquisitions have contributed to emergence of winner-take-most gatekeepers for the digital ecosystems that platforms operate. They orchestrate large numbers of interactions among their users, who depend on the gatekeeper for addressing scale economies and market failures that individuals cannot address themselves. In other words, gatekeepers exercise control over entire multi-sided markets that raise at least two antitrust concerns. First, multi-sided platforms become difficult to contest by existing or entering firms, irrespective of how innovative and efficient they might be. Second, producers and consumers have few alternate paths, outside the gatekeeper, to reach their target markets in an efficient way.

To address the competitive concerns from platform M&A, we need to go beyond traditional approaches such as ex post regulatory intervention. An ex post antitrust approach alone is too narrow and too slow for dynamic markers, while in many cases the harm cannot be undone. The combination of economic forces described above can lead to market tipping behavior whose opportunity losses cannot be recovered ex post. Traditional antitrust tools also need updating. Many platform markets do not lend themselves to traditional ex post antitrust analysis tools to define their borders. The Small but Significant and Non-transitory Increase in Price (SSNIP) test, which considers a small but significant increase in price as a prerequisite for assessing merger implications, fails when the optimal price is zero (Parker and Van Alstyne, 2000; Rochet and Tirole, 2003). Traditional theories of harm, such as market strategies that restrict supply, are less relevant in digital markets. Amazon does not restrict purchases, Facebook does not restrict posts, and Google does not restrict searches. Jacobides and Lianos (forthcoming) provide further challenges in defining relevant markets when using traditional antitrust tools. And, as noted, remedies that point toward divestiture fail to internalize network effect value.

Instead, as Parker *et al.* (2020) argue, digital markets need more structural solutions that rely on ex ante regulation, before damage occurs, as an additional instrument to complement ex post enforcement. This paper goes further by focusing on how we can combine ex ante regulatory instruments with merger control and antitrust enforcement. It deals with platforms that are central enough to be characterized as infrastructure gatekeepers based on the large volume of interactions they handle. It studies the M&A expansion strategies of these platforms as well as their impact on the competitive landscape. We analyze the potential anticompetitive harms of such acquisitions and argue that a new ex ante regulatory approach for information sharing, complemented with a proper update of merger policy analysis and tools, can help online ecosystems

1 For further examples in the Google Android case see: https://ec.europa.eu/competition/antitrust/cases/dec_docs/40099/40099_9993_3.pdf.

become more competitive and innovative with platform M&As that primarily promote efficiency gains and are beneficial for consumers.

The remainder of this paper is organized as follows: Section 2 briefly presents the core platform business models of the five largest western platforms: Amazon, Apple, Facebook, Google, and Microsoft (we refer to these firms collectively with the acronym GAFAM). Section 3 presents qualitative and quantitative evidence regarding the M&A activity of GAFAMs since the start of their operations. We also discuss how mergers contributed to the horizontal or vertical and conglomerate expansion of these platforms. Section 4 presents the main theories of harm as well as efficiencies associated with these mergers. Section 5 describes four proposals for ex ante and ex post policy intervention. It illustrates the basic principles of our regulatory approach and how it can address certain competition concerns related to M&As. We then discuss potential updates to merger policy analysis and competition tools so that they fit better the platform age. Section 6 discusses potential limitations of these proposals and Section 7 concludes.

2. GAFAMs as digital platforms

Digital platforms can be defined as open architectures with rules of governance that promote third-party interactions.[2] Openness allows partner entry. Governance incentives motivate participation. Mediating interactions creates value. Individual users or consumers visit the platform to consume goods or services through their interactions with other users and constitute the downstream side of the platform. Business users visit the platform to supply their products and services to the demand side and they constitute the upstream side of the platform. Put differently, a platform is also an "inverted" firm in the sense that a disproportionate share of value is created outside the firm rather than inside (Parker *et al.*, 2017) and the standard upstream–downstream labels blur. Users often create value for other users, as in the case of user-generated content, and suppliers often create value for other suppliers as in the case of shared developer files. GAFAMs have developed their own ecosystems in which they provide a variety of intermediary services but they are also present in the upstream market competing with external business users and in the downstream market orchestrating user behavior.

The interaction of users occurs through the platform's infrastructure. Platforms typically decide the access and governance rules that users should satisfy once they join their infrastructure. These rules also define the degree of openness of the platform and subsequently how value is created, balancing internal and external creation.

GAFAMs differ with respect to these aspects. For example, in the social media market, Facebook adopts an open infrastructure that allows app developers to provide functionalities that increase the (externally produced) value of the platform.[3] Better applications increase the probability of individual users to spend more time on the platform and interact with each other. The main source of revenue for Facebook is the interactions between individual users and advertisers through an ad-auction monetization mechanism. In contrast, Microsoft's LinkedIn adopts a more closed infrastructure, with more control and monitoring over app developers' products that become available in the platform, while keeping similar monetization strategies (e.g. promotion of content and relevant ads in exchange of a commission) as well as monetizing by providing executive recruiting services.[4]

Microsoft's core platform is its operating system for desktop and mobile devices (Windows). App developers (upstream side) design software applications that run on the Windows platform to make it more useful for its users (downstream side). Additional related platform markets are the ones of office software applications (e.g. Microsoft Office) and browser market (e.g. Microsoft Edge) where developers develop add-ons that expand their functionalities. Moreover, from GAFAM firms, Microsoft has been more engaged by developing a gaming platform that helps gamers and suppliers of relevant content to interact.

2 See page 9 of Jacobides, M., Sundararajan, A., & Van Alstyne, M. (2019). Platforms and Ecosystems: enabling the digital economy. *World Economic Forum*, Feb. 1–32.

3 However, the possibilities of the app developers to do that were somewhat restricted following the Cambridge Analytica scandal, with the imposition of new rules in favor of transparency and privacy protection.

4 https://business.linkedin.com/talent-solutions/recruiter, accessed 25 July 2021.

Apple exclusively attaches its platform model on the hardware it manufactures (e.g. personal computers and smartphones). Users of its hardware products can only get software applications through Apple's app store, which is the platform for their interaction with app developers. To participate in this app store, developers must comply with access rules and pricing policies as well as provide to Apple a commission[5] for all the in-app transactions they will be engaged with hardware users.

Amazon's core platform is an online marketplace for the interaction between supply and demand of products that are consumed physically or digitally. In addition, Amazon has developed a crowdsourcing marketplace (MTurk) for services that makes it easier for individuals and businesses to outsource their processes and jobs to a distributed workforce who can perform these tasks virtually.

Last but not least, Google's main platform operates in the online search market. But, the internet company has developed additional platforms like the Google Android mobile operating system, which is open source and facilitates interactions between software developers and mobile smartphone users.

One common characteristic of GAFAMs is that they are also present on the upstream side of the platforms they operate and manage. As a result, they directly compete with external business users such as suppliers of goods and app developers.

They also have explored further possibilities over the vertical structure of the digital value chain which gave rise to focus on new markets and digital applications that are linked to their core platform business. For example, Amazon has developed a system for distribution of its marketplace products which has become more efficient with its focus on robotic systems Apple is advancing its manufactured products parallel to its platform business and the software applications it designs for them. Amazon, Google, and Microsoft are the leading vendors in the Infrastructure-as-a-Service cloud computing market that help firms advance and improve their products without being constrained by costly investments in on premises infrastructure.

So, another common characteristic of these big platforms is that they have been pioneering in exploring promising avenues of the digital space that, while to some extent are linked to their core platform business, belong to the non-platform part of these firms' operations.

3. M&A strategies of big platforms

Platforms have developed distinct M&A strategies over time as their businesses have evolved. To understand these, we created a dataset of all publicly reported GAFAM M&As, from their inception to August 2020. For this dataset we relied on information on M&As provided by Crunchbase, Wikipedia, the Thurman Arnold Project at Yale University, and Microsoft Investor Relations Acquisition History. For each merger observation further research was performed to identify the price of the acquisition, the acquired firm, its specialization and the industry it belongs to, how the acquired firm was integrated in the business model of the big tech company, whether the acquisition involved technology transfer, talent acquisition, or both (balanced). We also collected public statements by the merged entities and used them to assess the motive of each acquisition and the strategic value it brings to the acquirer platforms.

The number of acquisitions for each of these firms is reported in Figure 1.a together with the month and the year of their first recorded acquisition. The total number of acquisitions is 855.[6] Google has the greatest average number of acquisitions per year since its first recorded M&A in 2001. Microsoft and Facebook follow with M&As since 1991[7] and 2005, respectively (Figure 1.b).

Figure 2 reports the number of M&As of each of these firms from 2000 to 2019. GAFAMs collectively increased their M&A activity in 2010 (mainly because of the increased M&A activity by Google and Facebook) while in 2014 the number of acquisitions reached a record number of

5 www.apple.com/ie/ios/app-store/principles-practices/, accessed 25 July 2021.

6 Out of this number, the percentage of M&As for each of the GAFAM is the following: Google 29%, Microsoft 31%, Apple 15%, Amazon 13%, and Facebook 12%.

7 Microsoft has only one reported acquisition in 1987 and the next one took place in 1991. We do not count the 1987 merger in Figure 1.a and b.

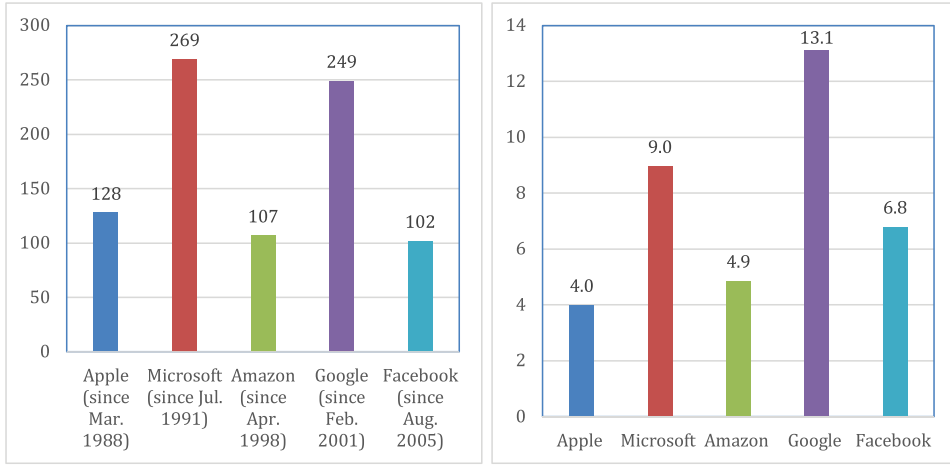

Figure 1. (a): Total M&As by GAFAM (855) from 1988 to 2020. (b): Average number of M&As per platform per year from 1988 to 2020

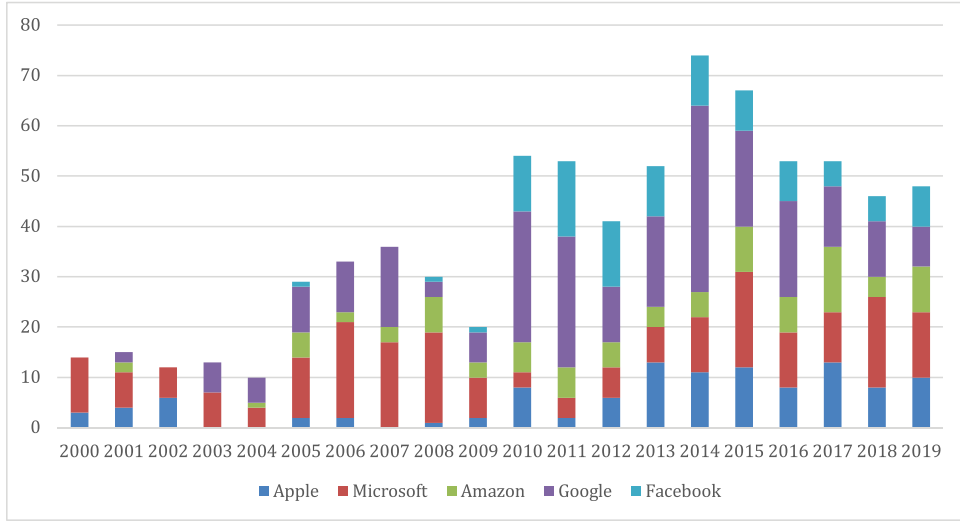

Figure 2. Number of GAFAM M&As per firm and year, 2000–2019

74 (out of which 37 were Google acquisitions). In the last decade, as discussed below, we have seen that GAFAMs have developed a significant M&A activity with the acquisition of either complementary or substitutable units that expand their business activities.

It is worthwhile to briefly describe the broad M&A plan of these firms. Starting with Amazon, we identify a phase of establishment first as an online retailer. Early acquisitions served as an opportunity for geographic expansion. Amazon entered the UK, Germany, and China as an online retailer. At the same time, Amazon acquired other online retailers whose specializations covered a wide range of products, thus combining the acquired firms' functionality and their customers' data to improve Amazon services. That also came together with the acquisition of specific tools that, on the one hand, can make the online retail experience more user-friendly and, on the other hand, can contribute to more effective monetization. For example, Amazon managed to outbid eBay to acquire LiveBid.com in 1999, the sole provider of live-event auctions on the Internet at the time. Amazon implemented LiveBid.com's technology on its online retail activities. Moreover,

the acquisition of Alexa Internet in the same year helped Amazon to better understand the online behavior of users and closely monitor how consumers reacted to its products and services.[8]

After 2006, Amazon expanded the range of its acquisitions beyond the establishment, improvement, and expansion of its online retail activities. It started to acquire firms relevant to its web services (which primarily focus on business users). Amazon also became more active in acquisitions in the field of media entertainment subsequent to its entry into the film and television industry through the Prime Video unit. In the last decade, Amazon Web Services became the most active unit of Amazon in acquisitions. At the same time, other acquisitions increasingly targeted artificial intelligence firms as well as firms that specialize in robotic systems and drones.

Amazon's most expensive acquisitions are those that added new capabilities or markets to its business model:[9]

- Zappos in 2009—Amazon initially tried to compete with Zappos in the online shoe retail market, through its subsidiary Endless.com, without much success. The acquisition of Zappos was an alternative way to increase its market prominence by eliminating one of its main competitors. Following the acquisition, Amazon closed Endless.com.
- Kiva Systems in 2012—The acquisition of the maker of service robots at warehouses allowed Amazon to improve the efficiency of operations at its fulfillment centers.
- Whole Foods Market in 2017—This allowed Amazon to integrate its digital infrastructure with a retail distribution network grocery store and the types of products offered by grocers. This integration proved to be particularly important during the coronavirus disease 2019 pandemic.
- Ring in 2018—This acquisition of a network connected video doorbell company signaled the ambition of Amazon to develop smart home devices with the help of its artificial intelligence technology.
- Pillpack in 2018—Amazon's acquisition of this online pharmacy signals the intention of the company to expand in retail markets for pharmaceutical products.
- Zoox in 2020—Zoox's ground-up technology, which includes developing zero-emission vehicles built specifically for aut

Moving to the second firm of our sample, Apple has, throughout most of its history, adopted a closed ecosystem for its products. Before the development of the iPhone and its associated App Store, a major objective of Apple's acquisition strategies had been to introduce additional functionalities in its core business of personal computers. These acquisitions had to do with relevant software applications that can run in the Macintosh operating system or that aim at updating the operating system. Interestingly, in 1997 Apple acquired Power Computing Corporation which developed clones that ran the Macintosh operating system. The objective of the acquisition was to replicate Microsoft's and Intel's success in fostering cheaper hardware in order to expand Apple's position in operating systems. However, Steve Jobs reversed the decision that same year because Power Computing was cannibalizing Apple hardware sales instead of expanding the market.[10] Without a license to use Apple's operating system software, Power Computing went out of business in 1998.[11]

With the development of the internet, Apple targeted its acquisition strategies toward information technologies that provided particular services for Apple's online network. Examples include identification of suspicious websites that are engaged in illegal activities, development of educational content for teachers and students compatible with iPod, and web applications relevant to office work. Apple also grew in music applications with the acquisition of SoundJam MP, one of the most highly acclaimed MP3 players for Macintosh.

The development of the iPhone and the associated App Store brought Apple to a new era that significantly affected its acquisition strategies. The focus shifted to human–machine interaction by

8 https://www.alexa.com/, accessed 25 July 2021.
9 The price of GAFAM acquisitions is often not reported. We are referring here to the pool of acquisitions for which the price was disclosed.
10 https://www.nytimes.com/1997/09/03/business/apple-decides-cloning-isn-t-its-route-back-to-profitability.html.
11 www.nytimes.com/library/cyber/week/013098power.html.

acquiring online applications related to its mobile operating system, maps and navigation, online search, the voice control software Siri (acquired in 2010 and later evolved into Apple's personal assistant), music and books, semiconductor manufacturing, database analytics, facial and speech recognition, mobile photography, and so on. During the last 5 years, Apple has been targeting firms that are active in artificial intelligence and its applications (especially those related to Siri), as well as in online payment services, and has developed an interest in autonomous vehicles. The secrecy of the firm over its merger deals makes it difficult to develop precise insight into the price of its most expensive mergers. Among the values that are disclosed, the acquisition of Intel's smartphone modem business and consumer audio products manufacturer Beats Electronics were the most expensive. Beats provided manufacturing capacity and also offered an online streaming service, which was discontinued when Apple moved its subscribers to Apple music. In the app space, navigator app HopStop.com was the costliest.

Facebook, the youngest of the five companies in our sample, started its M&A activity with a focus on creating a user-friendly social network experience. That motivated the acquisition of functionalities such as shaping an online conversation, enabling photo sharing, creating an environment for travelers to share their stories, and providing updates for live events or an online instant messaging platform. At the same time, other acquisitions focused on the monetization channel through targeted advertising techniques. The last 6 years, Facebook has been particularly active in the acquisition of companies that specialize in computer vision, virtual and augmented reality, artificial intelligence, and machine learning.

Facebook's three most expensive acquisitions were

- Instagram (acquired in 2012): a video and photo social network sharing platform. Its services are considered substitutes for those of the Facebook platform (see Argentesi *et al.*, 2021 for a critical review of this case).
- WhatsApp (acquired in 2014): a platform that allows its users to send text messages, make voice and video calls, and share images, documents, user locations, and other media to each other. This platform provides similar services to Facebook Messenger.
- Oculus (acquired in 2014): a producer of virtual reality headsets designed for video gaming. Oculus has been instrumental in the virtual reality unit of Facebook, motivating further acquisitions designed to augment and complement the virtual reality applications of the platform.

Facebook M&A activity has been motivated to some extent by the platform's competitive concerns. Facebook Chief Executive Officer Mark Zuckerberg and Chief Financial Officer David Ebersman, in their email conversation over the acquisition of platforms like Instagram, revealed by The Verge,[12] agreed that one of the objectives for such acquisitions is to neutralize competitors and to prevent them from growing and disrupting Facebook's market operation.

Similar concerns were raised in the acquisition of WhatsApp at the record price of $19 billion, the second most expensive acquisition by GAFAMs behind Microsoft's acquisition of LinkedIn (at a price of $26 billion). Published Facebook conversations and charts[13] illustrate that Facebook was monitoring WhatsApp and found out that its user base was steadily increasing in such a way that it could evolve to become a potential competitor to Facebook.[14]

Google's early M&A activity focused on establishing its presence in online search. The company pursued acquisitions relevant to the personalization of search services, customer relationship management, and the efficiency of its online advertising system. With the acquisition of Android in 2005, Google directed much of its M&A activity toward its mobile ecosystem.

12 www.theverge.com/2020/7/29/21345723/facebook-instagram-documents-emails-mark-zuckerberg-kevin-systrom-hearing.

13 www.buzzfeednews.com/article/charliewarzel/why-facebook-bought-whatsapp.

14 Gautier and Lamesch (2020) assign the potential killer acquisition motive to Facebook for the target firm Masquerade, a picture sharing app that offers filters for selfies. Their classification test involves the following conditions: (i) the core business of the acquired firm is at a market where the GAFAM has significant market power; (ii) the acquired firm should have a sufficiently large user base; (iii) the acquired firm should continue its business line after the acquisition.

Another important acquisition was YouTube which allowed Google to become a dominant firm in video sharing. It augmented the YouTube system with the acquisition of extra functionalities for desktop and mobile video sharing. In the last decade, the firm started investing in firms in the cloud computing market while, since 2013, it has focused on acquisitions in the field of home automation, artificial intelligence, image recognition, natural language processing, and machine learning.

The most expensive Google acquisition was its 2011 acquisition of Motorola mobility for $12.5 billion. This allowed the company to become more active in the smartphone market. However, facing losses, in 2014 it sold the hardware business to Lenovo for $2.9 billion while keeping Motorola's patent portfolio as a complement to the Android ecosystem.[15] Google's second most expensive acquisition was for Nest Labs in 2014, which helped the firm to gain a footing in the growing market for web-connected household appliances. The third most costly acquisition was DoubleClick in 2007, which became a core unit in Google's advertising strategy and dominance. DoubleClick offers technology products intended to increase the purchasing efficiency of advertisers and to minimize unsold inventory for publishers. Another merger of significant value was the acquisition of Waze in 2013, a Global Positioning System navigation software system with real-time crowdsourced traffic conditions. Waze provided a close substitute to Google's maps and navigator unit.

Microsoft's first reported acquisition in our sample took place in 1987 and the next one took place in 1991. Early acquisitions focused on software applications for personal computers and computer networks. They targeted new functionalities that were further developed to provide better home, office, and entertainment services. In 2000, the company began to acquire computer gaming assets. For example, Microsoft purchased Bungie studios in 2000.[16] The purchase allowed Microsoft to launch its Xbox game console with the exclusive game Halo, developed by Bungie.[17] Other acquisition targets included developers of tools that facilitate information sharing among online users and of web services that provide security and protection for online activities. Acquisitions shifted to mobile applications from 2007 while Microsoft also acquired the mobile phone business of manufacturer Nokia in 2013 to create the Microsoft Mobile unit.

Later acquisitions, apart from online gaming, also focused on the cloud computing market where Microsoft's Azure division is one of the industry's main vendors (together with Amazon and Google). The acquisition of developer platform GitHub in 2018 illustrates an acquisition strategy of purchasing assets that gain additional access to developer communities.[18]

Significant and costly acquisitions include

- aQuantive in 2007: The acquisition of this advertising network that provides digital marketing and technology solutions was integrated with Microsoft's online search engine Bing in order to better monetize users' search activities in the advertising side.
- Skype in 2011: The internet communications company supported Microsoft devices such as Xbox and Kinect, Windows Phone, and a wide array of Windows devices, allowing Microsoft to integrate Skype users with Lync, Outlook, Xbox Live, and other communities.
- LinkedIn in 2016: The professional social networking site introduced Microsoft in a new business line with the possibility to combine its software suite with the network's structure. This is the largest recorded acquisition in GAFAM history.

One relevant aspect to the acquisition strategies has to do with the type of asset that is acquired. The M&A deal can incorporate either a complementary technology transfer, where the new technology is integrated into the core of each GAFAM's technologies, increasing the functionalities of its digital ecosystem. The M&A deal might also serve as a means of hiring specialized personnel

15 www.theguardian.com/technology/2014/jan/29/google-motorola-lenovo-sale.
16 www.ign.com/articles/2000/06/20/microsoft-acquires-bungie.
17 www.sfgate.com/entertainment/article/Microsoft-puts-on-its-game-face-New-Xbox-isn-t-2856291.php.
18 https://hbr.org/2018/06/why-microsoft-is-willing-to-pay-so-much-for-github.

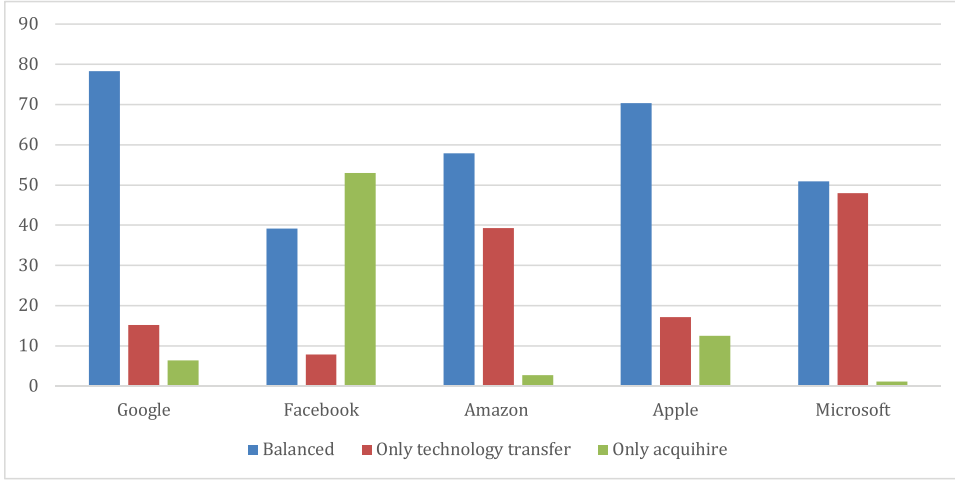

Figure 3. Mergers and acquisition goals: % balanced, % acquihire, % technology transfer

who have proven their ability to build novel and profitable digital applications (often referred to as acquihires). In many cases, an M&A deal serves both purposes.

Figure 3 presents preliminary results for the percentage of M&A deals for each GAFAM that incorporated a talent acquisition (acquihire) and the share of M&A deals that incorporated technology transfer (assets and technology, where technology was either patented or not patented). The column "balanced" refers to the percentage of acquisitions that incorporate both talent and technology. In addition, the percentage of technology-dominant acquisitions (only technology transfer is involved) and those where only acquihire took place are reported.

Google and Apple have the tendency to acquire both talent and technology at a share that exceeds 70%. Microsoft acquired technology in approximately 99% of its acquisitions, but it acquired talent in approximately 50% of its M&A deals. On the other hand, Facebook, tended to acquire talent through its acquisitions, at a rate of more than 92%, while technology transfer only occurred about half the time.

Overall, our data analysis suggests that the M&A strategies of these big firms can serve a number of purposes that benefit these businesses and create value. We develop the following typology of four overlapping broad categories of firms' acquisition strategies:[19]

- an additional complementary functionality that can help the company provide more efficient services related to its core business (examples are provided in Table 1),
- new functionalities, products, and services added in the vertical value chain that make the platform market more attractive (see Table 2),
- substitutable, competing services in firm's core intermediary or vertical markets of operation that reduce competition (see examples in Table 3 for each of the GAFAM firm), and
- human capital, either as talent employed by the target firm or a large user base orchestrated by that firm (see Figure 3).

4. Theories of platform M&A harm

M&A events occur frequently. In the European Union (EU), in the last 31 years, 8083 mergers have generated government notification (following the threshold notification policy[20] applied in

19 Kwoka and Valletti (2021) in this issue develop a somewhat more general typology in order to identify the potentially separable business operations of each of the major tech companies. Their focus is on substitutability and complementarity of merged functionalities, two of the key dimensions also included in our typology.

20 https://ec.europa.eu/competition-policy/system/files/2021-02/merger_control_procedures_en.pdf.

Table 1. Complementary functionalities integrated to the core platform services

Amazon	Apple	Facebook	Google	Microsoft
LiveBid.com (online broadcast service for auctions)	Schemasoft (developer of software components for facilitating digital information workflow)	Spool (facial recognition software for social networks)	Neotonic Software (provider of services for e-mail discussion groups)	Fox Software (provider of database software)
Accept.com (longer-range solutions to simplify person-to-person and business-to-consumer transactions on the internet)	Spruce Technologies (graphics software)	Storylane (online advertising services)	Applied Semantics (online advertising)	Altamira (image composition technology)
Touchco (in touch screen technology)	Snappy Labs (photography software)	Pebbles (provider of cellular network technology)	ZipDash (traffic analysis in online maps)	ShadowFactor (software for multiplayer internet gaming)
Goodreads (social reading service)	FingerWorks (multitouch technology)	Two Big Ears (developer of an application for recording video selfie animations)	reMail (search tool for e-mail)	OmniBrowse (wireless data services)

Table 2. New products and services added at the vertical structure

Amazon	Apple	Facebook	Google	Microsoft
Fabric.com (online fabric store that offers custom-measured and cut fabrics, as well as patterns, sewing tools and accessories)	Emagic (mapping company that offers mass transit information)	Pryte (developer of a pedometer that works with iPhone)	2Web Technologies (online spreadsheets)	Hotmail (web-based e-mail service)
Reflexive Entertainment (developer and distributor of video games)	PowerSchool (student information systems)	Wit.ai (in-house music production studio)	Marratech (video-conferencing)	FASA Interactive (interactive entertainment software)
IMDb (online database of information related to retail goods)	Spotsetter (technology, which involves layering social data on top of a maps interface)	Infiniled (platform for creating electronic products through a 3D printing process)	Upstartle (word processor)	CompareNet (online comparison—shopping services)

the EU) from which only 30 proposed mergers have been blocked and another 140 were cleared with the imposition of remedies.[21] The prohibition of mergers is not a popular practice because in many cases M&As either do not raise serious competition concerns or they generate efficiency gains that outweigh competitive harm. However, some observers such as Jenny (forthcoming) find the lack of prohibition to be more troubling:

21 https://ec.europa.eu/competition/mergers/statistics.pdf.

Table 3. Acquisition of firms that produce substitutable goods/services

Amazon	Apple	Facebook	Google	Microsoft
Bookpages (online bookstore)	Lala.com (music streaming)	FriendFeed (social media platform)	Orion (web search engine) Sprinks	Lionhead Studios (game developer)
Telebook (online bookstore)	MOG (music streaming)	Chai Labs (online sharing platform for travelers)	Aardvark (social search platform)	StorSimple (cloud-integrated storage solutions)
Zappos (online shoe retailer)	HopStop.com (online maps)	WhatsApp (messaging platform)	Episodic (online video platform)	R2 Studios (home entertainment)
Woot (online retailer)	Swell (music streaming)	Instagram (social media platform)	Plink (mobile search engine)	Mojang (game developer)

The inability of antitrust authorities to control the merger wave initiated by the GAFAM in the US and the fact that in Europe a limited number of cases brought by the EC Commission against Microsoft, Google or Amazon have not had a tangible effect on their behavior has meant that a number of critics argue that direct regulation of the GAFAM would provide a better way to control them than ineffective competition law enforcement.

We agree that merger regulation should prohibit market consolidations that reduce consumer welfare by restricting competition. Motta (2004) provides a general framework for the efficiency gains and the anticompetitive effects of mergers for one-sided markets. In the case of horizontal mergers, efficiency gains can emerge through improvements in the production process of products and services as well as in the development of greater quality products. The increased market power attributable to the merger should be analyzed in comparison to the efficiency gains that are expected to be realized in order to compute the overall welfare effects through counterfactual analysis (Jenny, forthcoming) on a case-by-case analysis. Horizontal mergers may also give rise to collusive equilibria that should factor into the analysis. When concentration increases across the vertical structure, competition concerns such as the risk of foreclosure may arise. However, vertical mergers can also generate benefits through the more efficient integration of the vertical chain that removes inefficiencies like double marginalization, the induction of lower production costs, and a better linkage of demand preferences with the production of goods.

For merger analysis in which digital platforms are involved, we need to adjust this general framework in order to capture the specificities of the big digital platform markets discussed above. As discussed in Section 3, M&A strategies can generate additional value by adding new functionalities in the horizontal or vertical chain. However, there are also competition concerns that should be addressed. We divide them into three broad categories:

- Dynamic competitive concerns,
- Horizontal and conglomerate merger concerns, and
- Vertical merger concerns.

Before we move forward with the competitive concerns of our framework, it is important to provide a practical distinction between the second and the third categories. To do that, we follow the "End-to-End" principle that Saltzer *et al.* (1981) used to distinguish what goes into the network layer (platform) and what goes into the ends (app layer). The principle suggests that high-use functions that most users need should reside in the core of a system where they are always available to all users. Less frequently used functions that appeal to niche subsets of users should be at the periphery (ends) where they can be consumed only by those who require them. The reason is that the addition of each system function incurs an overhead cost in reduced execution efficiency. The implication for platforms is that ecosystem partners, i.e. app producers, should provide the highly variable less frequently used functions in order to provide customized solutions in particular industry verticals. In-game animation is a *vertical* or end node example. This function is not universal and not all operating system users enjoy games. By contrast, the

platform should provide low-variety high-use functions that span industry verticals. Cut-and-paste is a *horizontal* example. All users and most office/productivity applications use it. Hence, it is more efficient to implement the functionality once, within the operating system itself, for use by any application on top. This principle is fundamental to the design of the internet and corresponds to the view of platforms as a core set of stable and slowly evolving functions under a layer of modular rapidly evolving functions (Baldwin and Woodard, 2009). Firms use the end-to-end principle to design business platforms (Parker *et al.*, 2016). For example, consultants from firms such as Infosys and Accenture create solutions on top of platforms such as SAP that are specialized for firms in industries such as automotive manufacturing, government services, and energy production. Critically, when functions provided by ecosystem partners become widely demanded, the platform is likely to acquire or replicate those functions in order to include them in the core system where they can be more efficiently provided to all users. Notably, the right to absorb functionality appears as a clause in SAP contracts (Parker and Van Alstyne, 2018). A consumer example of this transition is voice control that began as a separate application but has become part of the standard interface embedded in most operating systems. Absorption into the platform layer means that the platform reduces transaction costs where both users and developers must integrate disparate technologies, thus increasing consumer welfare.[22] Apple's acquisition of Siri, for example, illustrates a reduction of value to other speech app developers even as it increased iOS value to other speech using developers and all speech using consumers.

The distinction between horizontal/conglomerate and vertical mergers in platform markets incorporates the following dimension:[23] horizontal acquisitions require the merged entity to be integrated into core platform infrastructure in order to realize efficiencies of supply (beyond efficiencies of demand). Vertical acquisitions are added as functions, on top of the intermediary's digital infrastructure, adding value through efficiencies of demand. By the end-to-end principle, the former should affect many more users than the latter.

We first discuss dynamic potential harms that might result from mergers and acquisitions, especially when carried out by dominant platforms.[24]

The first theory of harm that we consider is the so-called killer acquisition. Killer acquisitions refer to the situation where incumbent firms acquire targets solely to discontinue the target's innovation projects in order to preempt future competition. Consumer welfare can decrease because consumers miss the benefits from increased competition as well as the alternative consumption choices from new products and services within the same market that would have developed if the acquisition had not taken place. Killer acquisitions can occur at the platform intermediary level, where potential competitors can develop future substitutable services to big platforms. They can also occur at the upstream level where platforms' upstream subsidiaries can be threatened in the future from the development of new products and services by new upstream competitors.

The term was introduced by Cunningham *et al.* (2020) who, using pharmaceutical industry data, showed that acquired drug projects by incumbent firms are less likely to be developed when they overlap with the acquirer's existing product portfolio. This is especially the case when the incumbent's market power is large because of weak competition or patent protection. The authors conclude that about 6% of acquisitions in their sample are killer acquisitions. These acquisitions usually escape antitrust scrutiny as they are often below the revenue notification threshold that would make authorities likely to investigate.

Comparing the pharmaceutical and digital industries, it is important to note that pharmaceutical markets have a clearer structure and better information flow regarding who the potential competitor might be (Cabral, 2020). Therapeutic markets are reasonably well defined. In addition, heavy regulation of drug development provides information to authorities related to the products as well as the agreements made across the production and distribution of drugs (e.g. the length and the validity of patent protection) and the relationship between generic and name brand manufacturers.

22 Absorption is modeled formally in Parker and Van Alstyne (2018).
23 This distinction becomes important for the policy recommendations of Section 5.
24 For additional theories of harm in specific environments see Motta and Peitz (2020). Here we keep the analysis of theories of harm in a general setting.

In digital markets, information structures and the identification of potential competitors can be much more difficult to ascertain—but not impossible. The development of market analytic techniques allows observers to closely monitor market trends and identify firms that are growing relatively fast in the same or in closely adjacent markets to ones where big incumbent platforms operate. For example, the UK parliamentary inquiry[25] revealed that

> *Facebook used Onavo to conduct global surveys of the usage of mobile apps by customers, and apparently without their knowledge. They used this data to assess not just how many people had downloaded apps, but how often they used them. This knowledge helped them to decide which companies to acquire, and which to treat as a threat.*

Big platforms are more likely to have such insights than the authorities responsible for assessing the market impact of mergers. This information asymmetry has made it more difficult for competition authorities to assign a killer acquisition motive in M&A activities.

Acquisitions that only involve talent acquisition (acquihire) can also be relevant to this theory of harm. Big platforms can acquire the talent from their competitors or potential competitors (with highly substitutable technologies) in order to protect their market position and eliminate the market competition threat. This does not mean that all mergers that only involve specialized human capital acquisitions are motivated by such strategic and anticompetitive motives. Especially, when they occur across the vertical value chain or when the acquired firm is not a competitor/potential competitor. Then, they can be linked with the efforts for a more efficient vertical integration of new functionalities with a parallel improvement of the management structure of the acquired firms.

A second theory of harm has to do with the impact of M&A on small firms operating in related markets. Empirical evidence from Koski *et al.* (2020) and Kamepalli *et al.* (2020) shows that big technology firm acquisitions can create a so-called "kill zone" effect. Namely, these studies have found that technology giants' buyouts subsequently reduced market entry rates and decreased the supply of venture capital funding and investment available to start-ups that operate in the target product markets of tech giants' acquisitions. The intuition for this result is twofold: first, once a big tech firm has acquired a start-up in a specific, closely adjacent, complementary, or conglomerate market, then this has a negative effect on other small firms in that market because they find it harder to compete with the technology giant. This occurs because of economic forces such as network effects, economies of scale, and data-driven economies of scope that are significant in big platform markets. When the technology giants enter, in this case through acquisitions, venture capitalists do not find it attractive to continue to invest in small firms in those markets (or potential entrants in those markets) as they feel that it is more difficult for their investment to pay off. Small firms and potential entrants are subsequently more constrained in investing in product solutions that can help them to enter and efficiently compete in the market.

Second, many firms launch their business and innovate with the purpose of going public or becoming acquired by bigger firms with terms that are profitable for their investors. This is particularly true in digital markets. The reward from exit (whether by initial public offering or from acquisition) provides the initial impetus to invest. For small digital firms that may not scale quickly enough to go public, it is nonetheless a sign of great success to be bought by a big technology firm. So, keeping the "acquisition dream" alive can have a significant impact on entrepreneurship and can be associated with more innovation and therefore with greater social value. Balancing this gain, incumbent firms may invest in the same technologies as start-ups in order to gain leverage when acquiring those start-ups. The threat of rent extraction by the incumbent can reduce investment by the start-up (Katz, 2021).

Once one of these firms is acquired by a big technology firm, the probability of acquisition for another small entrant that operates in the market decreases. There is a significant first mover advantage, and when the "winner" is selected by a big tech firm, it is harder for the remaining firms in the market to continue their business operations unaffected. Note that through such

25 www.parliament.uk/globalassets/documents/commons-committees/culture-media-and-sport/Note-by-Chair-and-selected-documents-ordered-from-Six4Three.pdf.

mergers, tech firms may seek to re-shape their industry architecture[26] and as such ensure the sector is more congenial to their technology ambitions, at the expense of competitors and other market participants.

Dynamic concerns can also arise when an M&A strategy of one firm is affected by the M&A strategy of its competitors. In this case, counterfactual analysis can give rise to new theories of harm. For example, following Nocke and Whinston (2013), let platform A acquire a firm. If, in the absence of this merger, platform B would have acquired the same firm, then it is relevant to assess the consumer welfare under the former and latter mergers rather than as a standalone firm. If, under alternate acquirer B, consumer welfare is higher, then the merger with platform A is undesirable. This suggests that there may be a preemption game in which firms race to propose a merger first. If the counterfactual analysis suggests that, if the merger is not approved, a welfare-enhancing merger deal will follow, then the first merger reduces welfare.

Bryan and Hovenkamp (2020) make a similar point. In a model with differentiated products, they show that an acquisition by a stronger potential acquirer prevents its rival from obtaining access to a new technology developed by the target firm. Thus, its motivation for the acquisition may be to exclude a weaker rival from gaining access to the target's technology, which may endanger the long-term viability of the rival.

Moreover, platform envelopment (Eisenmann *et al.*, 2011; Condorelli and Padilla, 2020) has important dynamic implications that can lead to market foreclosure: through envelopment, a big service provider in one platform market can merge with a firm that operates in another market and combine its own functionality with that of the acquired entity in a multi-platform bundle that leverages shared user relationships. In this way, platform envelopers capture market share in the new market by foreclosing the competitors' access to users. Hence, platform envelopment relies on network effects and leveraging market power from one market to the other, increasing in this way their market prominence across different markets.

Moving ahead in our framework, we now consider the case of a horizontal merger[27] between two platforms that serve consumers at a price of zero. Such pricing is often observed in two-sided networks where platforms can internalize network effects that cross different types of users (Parker and Van Alstyne, 2000, 2005; Rochet and Tirole, 2003) increasing the value created. However, the merged entity may be able to extract higher surplus from the side of the market that joins the platform to interact with consumers. Examples include advertisers, developers, and third-party producers. Platforms typically adopt monetization strategies that allow them to receive a payment for the interactions they facilitate. An advertiser, for example, has to pay a per-interaction fee to the platform to engage with consumers. If the merged entity is able, through increased market power, to charge a larger fee to the advertiser, it is very likely that part of this fee will increase the price of the advertiser's product paid by consumers on the other side of the platform market. So, the ability of the platform to extract higher surplus at the production side can create a competitive bottleneck (Armstrong, 2006) that leads indirectly to higher prices on the consumption side, thus decreasing consumer welfare. As the horizontal merger reduces competition in the production side and business users have less options to multihome, the merged entity is able to extract greater share of surplus in the upstream side by increasing prices imposed on business users.

On conglomerate mergers, it should be noted that they can incorporate efficiency gains through one-stop shopping (Klemperer and Padilla, 1997). Consumers, by visiting the merged entity's shop, can consume the bundle of products they want. They do not have to visit different providers for each of the standalone products they wish to consume. But, efficiencies can also exist in the supply side by the integration of additional functionalities on platform's infrastructures as already discussed. However, overall welfare implications depend on the degree of product differentiation and the magnitude of search costs. For example, Rhodes and Zhou (2019) study single-product firms that supply different products and can merge to form a multiproduct firm. They model

26 See the Jacobides and Lianos contribution in this issue.

27 The insights from non-platform markets can also be relevant to the evaluation of horizontal mergers and provide other potential theories of harm that should be properly assessed. See, for example, the analysis of Farrell and Shapiro (1990, 2010), Barros and Cabral (1994), and Federico *et al.* (2017, 2018).

demand as consumers who wish to buy multiple products and, due to search frictions, value the one-stop shopping convenience associated with a multiproduct firm. They find that, when search frictions are relatively low, the equilibrium market structure is asymmetric, with different retail formats coexisting. This allows firms to better segment the market and, as such, typically leads to weaker price competition with negative welfare implications for consumers.

Vertical mergers can generate additional concerns that eventually lead to market foreclosure.[28]

When a dominant platform merges with a supplier of services, then it may offer preferential access for this supplier to the demand side, restricting consumers' options as a result. At the same time, it may use the data and information it collects from external suppliers that participate in its ecosystem to the benefit of its own subsidiary when it designs its upstream selling strategies and products. In both cases, the playing field in the upstream market is distorted as the platform leverages its role as an intermediary to gain market power in the upstream market. Such distortions of competition may even lead to market foreclosure when big platforms enjoy a significant data advantage and network effects are prominent. Specific strategies with potential anticompetitive functions include self-preferencing, tying, and bundling practices as well as disproportionate access rules and platform participation fees.[29]

5. Regulation and merger policy in the digital age

The previous section identified three broad categories of potential problems related to M&As in platform markets: dynamic concerns, horizontal/conglomerate merger concerns, and vertical merger concerns. In this section, we propose solutions. These solutions involve a combination of ex ante regulatory intervention and ex post enforcement.[30]

Jenny (forthcoming) notes that "…some practices (such as, for example, data portability or interoperability) may be pro-competitive or pro-efficiency in certain ecosystem environments and be potentially anti-competitive or irrelevant in other ecosystem environments." Jacobides and Lianos (forthcoming) provide analysis of the limits of ex post regulation although they suggest that it can be useful in combination with ex ante regulation.

Following Parker *et al.* (2020), this paper follows an alternative path of ex ante regulation with a parallel adjustment of antitrust tools. In digital ecosystems, value creation can be related to significant economies of scale, data-driven economies of scope (e.g. economies of scope in data aggregation) and an increase in the value derived through network effects.[31] The same forces that increase competition concerns can also create value. Our main focus in the analysis that follows is to develop regulatory mechanisms that redistribute the created value in such a way that mitigates large platforms' incentives for anticompetitive actions.

To address the concerns that arise from platform M&As, this paper puts forth four proposals that are analyzed in turn. First, a proposal for the ex ante regulation of big platforms is developed in order to improve information flow in digital ecosystems and reduce the dynamic concerns related to the acquisitions under study. Second, new ex ante rules are proposed for minimizing market distortions across the vertical value chain, in order to mitigate concerns related to vertical mergers. Third, an adjustment of the merger notification threshold is proposed in the case of horizontal and conglomerate mergers, so that more M&As of big platforms fall under the scrutiny of antitrust authorities and potentially anticompetitive effects of these mergers are addressed.

28 See, for example, Comanor (1967), Salinger (1988), Chen (2001), and Rey and Tirole (2007) for antitrust analysis of vertical mergers in "traditional" markets. In addition, Petropoulos (2018) analyze the implications of vertically integrated industries for competition and related restraints.

29 In fact, market foreclosure may occur even in the absence of such abuses. Chen *et al.* (2020) illustrate the important role of data when the merged entity (e.g. a platform that acquires an upstream supplier) has access to more information than an independent upstream market competitor through excessive data collection and analysis. Then, it becomes more likely for the competitor to exit the market due to its inability to compete with the better informed (about individual consumer preferences) merged firm.

30 According to ex post competition policy enforcement, theories of harm in each of the three broad categories should be compared to the efficiency gains and value creation that are achieved through proposed mergers following a case-by-case analysis. But, as discussed in the introduction, ex ante rules can prevent potential wrongdoing before it occurs in dynamic digital platform markets.

31 See relevant discussion in the introduction, on why ex post enforcement alone does not suffice under the presence of such economic forces.

Fourth, we propose means to better assess dynamic effects of mergers. To do that, we update the merger policy tools in order to adopt a more forward-looking perspective when we evaluate merger cases in digital markets.

5.1 Proposal 1: New ex ante regulation—in situ data rights as a source of value and curb on M&A

Big tech platform ecosystems resemble a star network structure. The platform is at the center of this structure and connects its different sides (consumers, producers, developers, and advertisers). Through the data they collect from other market participants, platforms have superior information over the ecosystem which they can use to create ecosystem benefits by increasing the value of their intermediation services. As a platform facilitates a larger number of interactions, users can have greater challenges when switching to substitute intermediation services. Network effects favor match variety and match quality on larger platforms as illustrated by search and e-commerce.

The platforms observe user interactions on the same side or across different sides of the market. Consumers query the platform and receive responses. They browse through the proposed products and media items, possibly leading to click-throughs and monetized transactions. Interaction patterns change and allow the platform to monitor closely their users' preferences over time. Volunteered and observed data constitute raw data inputs into machine learning algorithms that derive useful insights and produce two-way information signals for users: responses to consumer queries and targeted advertising channels for sellers. These signals contribute to the efficiency of platform matching services between users (e.g. greater personalization of services, improvements in product/service quality, and so on). Raw data should be distinguished from processed platform data. Processed data are the algorithmic output signals that platforms send to users. Users contribute raw data, including volunteered data and behavioral responses to these signals that generate interactions within the platform.

Platform gatekeepers enjoy information advantages—knowledge of market activity and individual preferences—that contribute to their market power. The proposed ex ante regulation aims to distribute this value, often created by ecosystem partners, more evenly. We propose a new user right of information access that obligates gatekeeper platforms to allow third-party access to a user's raw data upon that user's request.[32] The governance model and the infrastructure that stores the data remain separate.

Raw data are always used at the location it is collected. Instead of transferring data to a competitor's online interface, where it is used as an input in its algorithmic exercises (as data portability dictates), it is the third-party algorithms that are transferred to the platform's infrastructure where the data are located, in order to perform its data analysis. Individuals may choose to grant third-party access to their data in situ rather than remove it and port it elsewhere.

An in situ rights regime grants users all the benefits of data portability but confers several additional benefits. Context is preserved rather than lost, as in the case of friends' posts that do not belong to a user.[33] Data do not grow stale but rather include both stocks and flows of activity. And data remain actionable such that one might reach a friend or make a purchase based on that data.[34] Giving users control of data where it resides allows them to invite third parties to compete to create benefits with the host site, prompting greater sharing of value. In the absence of access to the infrastructure, certain benefits cannot be created.

32 Behavioral responses inside the platform are co-generated data between the platform and its users. Under the current EU data regulation settings, sharing or trading co-generated data requires the consent of the co-generators or anonymization to break the link to identifiable parties. This data protection right is very explicit for natural persons.

33 Berlind (2017), for example, showed that downloads of personal Facebook data do not include posts by friends and colleagues—that is their data. Lack of context renders the data less useful. The intuition is the following: personal data of a user in a digital platform is used in a context, or in other words, as part of an interaction with another user of the platform. When data of the one user are ported, but the data of the other user with whom the first user interacts are not, ported data lose their context and therefore their value declines. With in situ rights, in contrast, personal data retains its value when accessed by other firms.

34 Off-platform, data cannot be used to make a post or purchase i.e. to push a transaction, or to receive a reply or benefit, i.e. to pull a transaction, unless it is re-paired with that platform. By accessing data in situ, this problem becomes obsolete.

The in situ mechanism works as follows: entrant platform B requests from its user i permission to access her raw personal data located in gatekeeper platform A. Once user i gives her consent, platform A grants access to its user i data to platform B. Then, platform B can access user i's raw data at its location on platform A and use that data as an input for running its algorithmic applications on that site. In other words, instead of bringing the data to the entrant, the entrant's algorithm can be brought to the data located at the infrastructure of platform A. User i's data are not transferred outside the infrastructure of platform A at any point in this process. However, platform B, through algorithmic analysis on site, can gain unique insights over user i's preferences and thus provide better services to her. This enables efficient information sharing.

It is important to note that the newcomer platform gets access to the user's raw data collected by the incumbent before the incumbent has processed it through its algorithmic system. Hence, incumbent incentives to process that raw data are not negatively affected. Indeed, symmetric access to raw data among parties trying to create user benefits provides increased incentives to innovate and provide better services to users.

In other words, competition shifts from collecting data to analyzing it. This is exactly the stage where most innovative ideas are observed in digital markets. Competition that is facilitated by more symmetric access to information leads to extra incentives to create better algorithmic systems and improve market performance to the benefit both of users and successful innovators.

Information sharing will not only allow platform B to compete more effectively with platform A within its core markets, but should also increase competition for new unexplored markets, as platform A will no longer monopolize user i's data. Instead, platform A should intensify its efforts to develop novel value to the benefit of online users before its competitors do.

Expansion of platform A to an existing market will also be affected, as will its incentives to engage in conglomerate merger activity (especially in relation to the dynamic concerns identified in Section 4). Incumbent firms in these markets can use the in situ mechanism to gain new insights for their clients that are relevant to the quality of their offerings. Symmetric access to data and insights imply that platform A will find it harder to expand operations to new markets, relative to asymmetric access, unless expansion brings significant efficiency benefits. In other words, more symmetric information access should lead to an endogenous contraction of reasons to expand platform boundaries. The opportunities for dominant platforms to expand to adjacent markets remain, but will require innovations that do not rely on information asymmetries stemming from data monopoly.

In situ access will also impact the dynamics of the horizontal mergers because it links the private value of these mergers with their social value. Such mergers can incorporate efficiencies that come from demand and supply economies of scale and scope. The in situ mechanism enables the redistribution of these efficiencies across all market participants including competitor intermediaries, third-party producers, and consumers. The obligation of big platforms to open their infrastructure to their competitors should also trigger sharing efficiency gains related to their M&As. This includes the extra value of network effects by facilitating interactions outside the big platform as well as quality improvements related to data aggregation since the additional valuable information contained in the data of the merged entity can be accessed more evenly.

Information sharing will also increase the value generated through network effects. It should be possible to build a large network where users can link the information they generate in one platform with that on another. Benefits derived from cross-linked data, such as personalization and learning from adjacent interactions and adjacent users, can now be created by third parties. For example, a user of Amazon's shopping service could authorize an entrant to search her order history to create personalized recommendations based upon past purchase behavior.

Enabling in situ rights for users enables competition among platforms. For example, once authorized by a user, Amazon could recommend books based on a user's Facebook network or Facebook could recommend friends based on that user's reading history. In the absence of in situ rights, only Amazon and Facebook had that power within their own platform. After in situ rights, platforms may offer benefits to their competitors' users, fostering the sharing of created value. So, the in situ mechanism facilitates a more symmetric information ecosystem where firms can overcome each other's data barriers, engage in fairer competition, and share created value with consumers.

A potential challenge for newcomer platform B is to gain the consent by many users for in situ information sharing. It needs enough consenting users to reach a critical mass of information to run its services more effectively. A regulation that provides a clear and secure framework for in situ exchanges can increase the scope and the economic incentives for the formation of consumer data unions or pools (Lundqvist, 2018). A novel twist is to allow data unions to manage rights as distinct from managing the data. Cooperatives, together with in situ rights, significantly expand the possibilities for individuals to both monetize and increase the value of the services they receive when they act as a team. As aggregation can improve the generated value in the platform ecosystem, new platforms and firms will be inclined to provide additional benefits to individuals in order to reach the critical mass necessary to provide high-quality services. So, individuals will receive either specific benefits or better services if they consent to supply their information as a team, with derived value growing in the size of the team.

This is an additional benefit of in situ access rights in comparison to portability rights. Data pools have not typically succeeded due to (i) the fact of friction in removing data from a source platform and either self-managing it or reuploading it to a destination platform, and (ii) lack of actionability of data pools not tied to a platform. The rights provided by in situ access address both issues, reducing friction and ensuring actionability. First, individuals need only provide their consent to access their data—consent that can be revoked at any time. They do not have to remove and upload data themselves. User costs are minimal. Second, the created pools only need to manage consents and not data, which significantly reduces management costs. Third, the actionability on the side of the platform is ensured by the obligation to open its infrastructure and provide in situ access.

In practice, information sharing will take place through the employment of application programming interfaces (APIs). In addition, there needs to be a system of "federated APIs" that allow a digital firm to get access to the data of a given user which is located in multiple big platforms at the same time, provided that user has given her consent. For example, a user can give her consent to the Zalando platform for in situ access of her data located at big platforms like Amazon and Google at the same time.

For the new ex ante regulation to be effective in improving the information sharing across digital ecosystems, it also needs to incorporate some minimum standards over how firms can get access to big platforms' infrastructure and over how data need to be organized in order to be accessed in situ. That essentially requires some standardization over the collected raw data and its reorganization within the platform that collects it, as well as in situ APIs which will allow the firms to design accordingly their algorithms that will run on the data within the platform's infrastructure. Instead of standards related to how data are exported (in the case of data portability), we need standards on the design of algorithmic systems that are transferred to big platforms' infrastructures for access to data on site.

The in situ mechanism can also be supported by new privacy preserving software applications that can ensure the compatibility of the new ex ante regulation with privacy regulations like the EU's General Data Protection Regulation.[35] In many applications, the data of one user may reveal information about other individuals who did not provide consent for their data to be accessed. Since data always remain on site, behind the firewall protection of platform's infrastructure, it is possible to encrypt the data of other individuals that interact with the user that gives her consent for in situ access. For example, secure multi-party computation can be applied in order to both preserve the privacy rights of other individuals as well as the value of data accessed.

There are two examples of how rights similar to in situ have been implemented in real markets. The first refers to bank account holder information and regulatory instruments such as the EU's Payment Services Directive 2 and the UK's Open Banking Programme. These regulations include the logic of the in situ mechanism in the payment initiation services that the established financial institutions are obliged to offer: A payment can be initiated through the bank account via API. The processing is done through the bank's technological system. The account holder

35 Similar to Kira *et al.* (2021) in this issue, the relationship and the interconnections between data protection and market regulation are not always straightforward. The in situ data rights are designed in a way that both solve competition concerns and ensure high privacy standards.

should consent and provide to a third-party provider (e.g. a small fintech firm) credentials that are used for the authentication and security of the payment process. Then, the third party sends these credentials via API to the bank to verify the request to initiate a payment.

The open algorithms (OPAL) project[36] has also implemented such a mechanism. It aims to unlock the potential of data collected by private organizations "by bringing the code to the data through open algorithms and safe and fair technological and governance systems for better decisions in support of the sustainable development goals around the globe." The real-world deployment of OPAL started in mid-2017 in Colombia and Senegal. The main characteristic of this project is that algorithms are used in the data infrastructure of private companies behind the firewall protection with the goal of deriving key indicators in situ that are shared with the users of the ecosystem.

This ex ante regulatory proposal reduces dynamic incentives for M&As with a scope to protect gatekeeper positions from competition. Gatekeepers lose information rents born of information asymmetry and new entrants can capture network effects that benefit pools of users. M&A activity, whose purpose was to increase information asymmetry, falls as gatekeeper incentives for killer acquisitions or the kill zone effect also fall.[37] Market entrants can access the necessary market information that can help them design their products and services more efficiently and attract consumers. Such information can also help them to differentiate from the services of the gatekeeper and experiment with new consumer services that can bring additional benefits to the ecosystem.

5.2 Proposal 2: A mechanism to mitigate vertical concerns

We propose a mechanism that is designed to mitigate one source of potential harm from vertical mergers. These rules are designed to enforce a code of conduct for vertically integrated platforms But, they can be of help in addressing the vertical merger concerns presented above. As discussed, vertical mergers may lead to a conflict of interest in the intermediary level. When large platforms acquire an upstream supplier that uses the platform's infrastructure to interact with other users on the demand side, they may have increased incentives to actively promote the products of their upstream subsidiaries at the expense of third-party upstream market suppliers. This can create signification distortion in competition at the upstream level when the platform is a necessary gatekeeper for the interaction of supply and demand. This proposal builds on the in situ mechanism (proposal 1). The key characteristics of our proposal are as follows:

- In order to maintain "equality of access," gatekeepers should maintain a technical and legal firewall between upstream subsidiaries and their horizontal operations such that external suppliers enjoy the same access to the horizontal system that the platform's own vertical subsidiaries do. To make this possible, gatekeeper platforms must also report the access and matching criteria of for all vertical suppliers interacting with the demand side. Gatekeepers' own vertical operations must operate on identical terms.
- Potential competitors should be able to assess whether the platform is adhering to its published access and matching criteria and whether the platform is providing non-discriminatory access to other users of the system. Competitors' ability to determine this is created by the "in situ" access put forth in proposal 1. Transparency and openness of technology may also be required to enable verification of compliance. Importantly, competitors, perhaps more than regulators, are likely to have the expertise and incentives to carry out such analysis.
- To handle exceptions, we propose that competition authorities be able to assess gatekeeper systems to determine if their published criteria are truthful in practice. For that they need to ensure their access to the platform's infrastructure so that they can experiment with the platform's algorithmic system. This is a subsidiary mechanism as we expect that most investigation would be carried out by competitors.

36 www.opalproject.org/home-en, accessed July 25, 2021.

37 Probably, such incentives are not completely eliminated as other strategic motives, like elimination of new algorithmic systems may be still in place.

- If the gatekeepers are found to violate the principle of upstream equal treatment, a sufficient punishment should be imposed. One possible punishment option should be the full vertical separation of the platform from the upstream subsidiary.[38] More generally, the punishment options ex post should be designed so as to provide sufficient gatekeeper incentives to avoid anticompetitive behavior ex ante.

A crucial point is how to define the gatekeeper platforms for which the obligation to open their infrastructure for the in situ and the vertical mechanisms will apply. The recently published Digital Markets Act (DMA) by the European Commission provides a useful definition.[39] Specifically, a platform is a gatekeeper if it

- *has a strong economic position, significant impact on the internal market and is active in multiple EU countries,*
- *has a strong intermediation position, meaning that it links a large user base to a large number of businesses,*
- *has (or is about to have) an entrenched and durable position in the market, meaning that it is stable over time.*

In practical terms, the DMA sets as criteria an annual EEA turnover equal to or above €6.5 billion in the last three financial years, or a market capitalization of at least €65 billion in the last financial year. In addition, the gatekeeper status requires more than 45 million monthly active end users and more than 10,000 yearly active business users in the last financial year. These thresholds are expected to fit GAFAMs as well as a handful of other platforms. So, they capture the big platforms of digital ecosystems, for which the three categories of competitive concerns are more relevant.[40]

We should note that the DMA also includes a list of obligations (Article 5 and Article 6) for the operation of gatekeepers, many of which deal with how they treat consumers and business users. There are also specific obligations that point toward vertical integration, data portability, and protocol interoperability.

While the DMA moves, in principle, in a better direction, we believe that first priority should be to establish a regulatory framework that enables in practical terms a more symmetric information flow in digital platform markets. A more structural solution provides directions on aspects related to the platform's infrastructure, privacy protection through data encryption, and the imposition of minimum compatibility standards on how information should be shared which may be helpful in this respect.

With respect to the vertical mechanism and the access to big platforms' infrastructures by the authorities in order to assess potential bias across the vertical structure, the DMA aims at introducing a new enforcement mechanism through the online inspections on gatekeeper platforms:[41]

> *During on-site inspections the Commission and auditors or experts appointed by it may require the undertaking or association of undertakings to provide access to and explanations on its organisation, functioning, IT system, algorithms, data-handling and business conducts.*

Such inspections can help authorities to better understand digital structures and assess the validity of theories of harm. Access to algorithmic pieces of code will not make any significant impact, with this respect. What is more important is the ability of the authorities and competitors to use the algorithm for experimenting with algorithmic inputs and outputs to better assess the existence of a bias.

38 Break-ups can be a realistic solution if regulation cannot effectively address competition concerns. See relevant discussion in Kwoka and Valletti (2021), Khan (2019), Patel (2020), and Van Loo (2020).

39 Also see Caffarra and Scott Morton (2020) for a summary of the European Commission Digital Markets Act: https://voxeu.org/article/european-commission-digital-markets-act-translation.

40 It should be noted that such thresholds tend to introduce distortionary behavior at the boundaries.

41 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020PC0842&from=en.

The existence of a clear and transparent vertical mechanism and the possibility of on-site inspections can also incentivize firms that feel they are treated in an unfair way by the platform to file a complaint to the authority for further investigation inside the platform's infrastructure. Even if authorities will not be able to capture all the complex interactions between platforms and business users at the vertical structure, such complaints can lead authorities directly to the exact relationships they need to evaluate. That implies that authorities should update their expertise for participating in the proposed vertical mechanism by hiring data scientists, computer programmers, and engineers.

5.3 Proposal 3: Compulsory merger notification and a partial reversal of the burden of proof

While there has been an increase in the M&A activity of big tech platforms in the last 10 years, the vast majority of them have never been investigated, nor have competition authorities been notified. Kwoka and Valletti (2021), in this issue, report that approximately 97% of M&As in these markets have never been vetted. There is therefore a clear information (and possibly enforcement) gap in this space, especially, since there are dynamic concerns that need to be evaluated, while market structures and definitions are often not clear in the digital space before a proper investigation takes place.

Some scholars have argued that we need to reverse the burden of proof in merger cases of large platforms.[42] This reversal would imply that gatekeeper platforms should provide an objective justification over the efficiency defense for their acquisitions. However, we should note that such a policy can have a potential negative impact on entrepreneurship and start-ups. As already discussed in Section 3, many small firms launch their business in order to convince investors to support and help them to innovate with the purpose of becoming acquired by bigger firms.

Reversing the burden of proof universally, which basically suggests that there is a presumption that all mergers in the digital sector are anticompetitive. This is excessive and unnecessary, especially, given the negative impact it can have on entrepreneurship. It is preferable to reverse the burden of proof for a limited number of horizontal merger cases where they seem to be the most problematic with respect to their potential anticompetitive effects.

In the case of vertical mergers, the in situ access and the vertical mechanism discussed in proposals 1 and 2 should be sufficient to ensure that the social value of mergers exceeds the potential competitive harm. As a result, under the proposed regulatory approach, it is not recommended to reverse the burden of proof for vertical mergers because it will mainly distort investments and innovation by small firms.

According to merger regulations in most jurisdictions, notification is obligatory if the acquisition exceeds specific turnover thresholds.[43] These thresholds imply that most big tech mergers are not notifiable.[44] Indeed, they often involve start-up firms whose revenues are modest.

The DMA (Article 12) obligates gatekeepers to notify authorities of all their M&A activity (essentially bringing the notification threshold to zero for gatekeepers). We agree with this approach. It is important for the authorities to start investigating a larger number of gatekeeper

42 See, for example, the 2019 Stigler report of the subcommittee on market structure and antitrust (p. 98 at www.chicagobooth.edu/-/media/research/stigler/pdfs/digital-platforms—-committee-report—-stigler-center.pdf) chaired by Fiona Scott Morton.

43 In the EU there are two alternative ways to reach the turnover thresholds for mergers. The first alternative requires (i) a combined worldwide turnover of all the merging firms over €5000 million and (ii) an EU-wide turnover for each of at least two of the firms over €250 million. The second alternative requires (i) a worldwide turnover of all the merging firms over €2500 million, (ii) a combined turnover of all the merging firms over €100 million in each of at least three Member States, (iii) a turnover of over €25 million for each of at least two of the firms in each of the three Member States included under (ii), and (iv) EU-wide turnover of each of at least two firms of more than €100 million. See https://ec.europa.eu/competition/mergers/procedures_en.html, accessed July 25, 2021.

44 In principle, even when a merger does not require notice, the authority has the right to investigate it. But, in practice, this occurs very rarely. In the EU, in addition to the EU-level thresholds, there are also notification thresholds at the level of the member states. So, if a merger does not meet the EU thresholds, it does not mean that it will avoid merger control. Instead, it may face merger control in one or more of the 27 member states. In addition, there is a referral mechanism that allows the Commission to review a merger, at the request of the member states, if the acquisition requires notice under the national competition law of at least three member states. For example, the referral mechanism applied in the mergers of Facebook/WhatsApp and Apple/Shazam and were investigated by the European Commission despite both being below the EU threshold.

M&As. This is also an opportunity to learn how these platform markets work and which theories of harm are relevant. Compulsory notification will also mean greater transparency over merger deals. Our efforts to put together a data sample with the acquisitions of GAFAMs made us realize that, in many cases, there was not adequate information publicly available over the terms of and motives for the deals. More transparency will help to better assess the welfare impact of these mergers. The price of the merger and the number of users affected should also be disclosed as these may drive strategic motives behind the acquisition.

In addition, it is important to call for disclosure of the strategic intent of any proposed M&A. In particular, big platforms should report whether they intend to integrate the acquired firm in their infrastructure or have it operated as a vertical unit. Integration to the platform's infrastructure takes place, for example, in horizontal merger cases and implies that the data of the merged entity will be subject to the in situ access obligation. In vertical mergers, the in situ access obligation does not apply to the merged entity's data.[45] Still, the vertical mechanism presented above applies. In order to prevent vertical mergers from being used strategically to prevent rivals from having access to the acquired firm's capabilities, acquiring firms who wish to pursue an M&A deal under the vertical merger rules should be required to continue or expand vertical multihoming across different platforms. This prevents gatekeeper firms from acquiring vertical targets in order to foreclose user access from other platforms.

For example, consider Google's 2013 acquisition of Waze and its 50 million users. The Waze system uses crowdsourced location information at two levels. The first is to give real-time updates such as traffic accidents or police activity and the second is to maintain and improve the core maps.[46] Google continues to run Waze as a standalone system that is available on the competing Apple iOS system as well as Google Android; so by our criteria, we would classify this as a vertical merger. Given this multihoming, the burden of proof to establish the harm of such a vertical merger would therefore fall on competition authorities. Interestingly, over time, a number of features from Waze have begun to make their way into the core Google mapping service.[47] This absorption of capability into the Google core is likely to generate user value under the end-to-end principle described in Section 4. However, it begins to raise the likelihood that this could be viewed as a horizontal merger if Google should begin to foreclose rivals' access to Waze functionality. That in principle would have meant that the burden of proof should have shifted to Google who would then be required to demonstrate that the benefits of the merger outweigh the potential costs. Since the reversal of burden of proof can be applied only once, in the pre-merger case, to reduce the risk that platforms can game the framework of rules and mechanisms we propose, it is the instrument of contingent remedies that can be relevant. Over time, at the post-merger phase, when new developments around the merged entities require further actions to minimize competition concerns, new remedies can be imposed (see proposal 4).

To summarize, we offer contrasting advice in the case of horizontal/conglomerate mergers. When the platform acquires a small competitor and merges it into its infrastructure, the concerns are again small and can be addressed through the regulatory framework that enables the in situ access. However, we would put the burden of proof onto platforms in the case where the merged entity has a significant turnover and/or user base. Thus, we propose to establish a turnover and/or user bases threshold policy where platforms that wish to merge should be required to provide a defense of the merger that shows the likely efficiency benefits from data aggregation, economies of scale, and internalization of externalities exceed the potential harm of reduced competition. This is a narrower reversal of proof than the general one that has been proposed by some experts. Typical examples of past M&A cases that would fall under this category are the Facebook–WhatsApp and the Facebook–Instagram acquisitions.

We note that with such a change in notification regime, authorities' resource constraints might become binding. If so, the budget of the authorities should also be adjusted to allow the antitrust authorities to investigate more mergers in the digital space. During investigations, competing

45 Still, it is possible for the upstream third-party competitors to get in situ access to the platform's infrastructure.
46 https://techcrunch.com/2013/06/11/its-official-google-buys-waze-giving-a-social-data-boost-to-its-location-and- mapping-business/.
47 https://techcrunch.com/2013/06/11/its-official-google-buys-waze-giving-a-social-data-boost-to-its-location-and-mapping-business/.

firms may also be invited to submit relevant analyses. In this way resource constraints can be relaxed.

The supporters of the general reversal of proof policy also considered this policy as a solution to the resource constraints of the authorities. However, note that any objective justification brought by big tech should be thoroughly investigated to assess its validity. There should not be a free lunch. That implies that resources should be consumed in any case for evaluating big platforms' claims. Moreover, there are other instruments that can be designed if the authorities face resource concerns (even after their budget increase we refer to above) without reversing the burden of proof. A promising solution to the resource constraint problem is to design instead antitrust review fees that are proportional to the value of the proposed digital platform merger. These fees can either help the authorities to grow their workforce or rely on the external expertise of independent consultants and academics when they evaluate such cases. The fee should be such that it does not discourage the big platforms to acquire smaller firms (and especially start-ups). Proportionality of the fee on the value of the merger can balance both incentives on the one side and resource constraints for a thorough merger investigation.

5.4 Proposal 4: Merger analysis that captures the dynamic impact and the update of merger enforcement tools.

Mergers in big digital platform markets require a more thorough investigation of the dynamic effects of a merger. From proposal 1, the in situ mechanism can reduce dynamic incentives for acquisitions that seek to leverage data and infrastructure for gatekeeper benefit. This is a first step toward a correction.

We propose a mechanism to carefully compare the dynamic efficiency gains with the anticompetitive concerns of increased concentration considering the presence of network effects and data synergies of the merged entity as well as economies of scale both in the supply side (in the case of merged substitutable services) and demand side (in the case of a merger of complementary services). Petit and Teece (forthcoming) in this issue consider this as an impossible task. We respectfully disagree and offer some advice and methodological guidance on how to achieve it.

When merged firms offer substitutable services, we need to weigh the extra value that is generated in the ecosystem (whose fair distribution can be assisted through the in situ mechanism) and the lack of competition by removing from the market one substitute service. Crucial questions to answer are

- Degree of substitution and how this might evolve over time. Would we expect the substitutability between the two services to increase?
- If the proposed merger between the gatekeeper and the smaller firm is not allowed, is it likely that another platform will acquire the small target? Would that merger increase the competitive pressure exerted on the gatekeeper? Is society better off with the acquisition target as a standalone firm, a part of one platform, or a part of that platform's competitor?

The expectation of an increase in the substitutability of services can indicate the potential of greater competition in the specific service market to the benefit of consumers. However, we should also weigh potential social gains from saving wasteful duplication of investment (in the space of making services more substitutable) which may offset certain gains from competition.

When we analyze mergers of complementary services that involve a gatekeeper, we need to assess whether the efficiencies from the demand economies of scale and data synergies overcome the anticompetitive effects. In this analysis, it is important to consider the potential market strategies that may be employed:

- Tying, bundling, and any other market strategy that is designed to leverage market power from one market to a complementary one. A careful welfare analysis is needed to examine whether such strategies are welcome. But, a dynamic perspective also requires us to consider whether the big platform could develop that complementary functionality by itself if the merger is not allowed. The replication may be of inferior quality as compared to the one

offered by the small firm. In such a case, the small complementary firm may find it hard to compete with the big tech giant because of the platform's bundling of its complementary services and/or the presence of network effects. Consumers may end up consuming an inferior product in the complementary market, as occurred in the 1999 Microsoft antitrust case.[48]

- Data synergies can also be an important dimension that can help the merged entities to provide more efficient services that its competitors in the complementary market may not be able to offer.

Specific attention should also be paid to the quality of products and services.[49] It is possible for the gatekeeper to win a new market with an inferior product. By acquiring a low-quality firm, it creates a kill zone that puts high-quality firms out of business. The implication of the M&A in that case is an inferior product that is consumed in the complementary market.

The potential impact of the proposed merger on innovation efficiency defense should be examined more thoroughly. Veugelers (2012) finds that in the EU merger control, the assessments of the innovation effects of mergers are very limited.[50]

Last but not least, particular attention should be paid to the details of the merger deal such as the price of the takeover or whether the acquisition only involves an acquihire or also technology transfer, as it may signal strategic motives. If the price is disproportionally high for a specific acquisition, it might be because the acquired firm poses a threat to the acquiring platform.

Authorities should develop a more forward-looking perspective when they evaluate merger cases, especially the ones that raise the suspicion of a killer acquisition, namely, an acquisition that seeks to eliminate a potential future competitor. To do that, they need to assess what the potential competition effect is if the merger is not allowed. Would WhatsApp become a direct competitor of Facebook in its core business if the merger was not allowed? Could WhatsApp partner with a different large platform that does not have a strong social network? If the answer is likely to be yes, then the merger may decrease consumer welfare because it restricts potential competition that could lead to lower prices and higher quality and therefore be prevented. But, in practice, it can be challenging to assess counterfactual competition.

One avenue that can be helpful with this respect could be to measure the substitutability of platforms' services during the merger evaluation and how it evolves over time. The methodology of Brynjolfsson and Collis (2019) can be helpful in that respect. They use digital survey techniques to run massive online choice experiments examining the preferences of hundreds of thousands of consumers. They estimate the consumer surplus for a great variety of goods, including the ones that are offered at zero price and they find that the median compensation Facebook users were willing to accept to give up the service for 1 month was $48. On this basis, they estimate that U.S. consumers have derived $231 billion in value from Facebook since 2004 (Brynjolfsson *et al.*, 2019).

Such an experiment can be easily extended by assessing what would have been the choice of a user if one of the services a platform provides were not available. Users' choices in such a case can assess the degree of substitutability between services of different digital firms. If such an approach is combined with an assessment of the substitutability on the other side of the market (e.g. advertising), which typically exhibits positive prices and where it is therefore easier to apply standard antitrust methodology, we can get a more comprehensive picture over the competitive pressure for the provision of a particular service and its underlying interaction.

In other words, authorities should rely more on the online channel for understanding zero price markets where traditional market definition tools can be problematic. With the employment of surveys, online questionnaires, and choice experiments, they can ask users (through a design that

48 Jackson, T. P. 1999. U.S. v. Microsoft: Findings of Fact. United States District Court for the District of Columbia, Washington, D.C.

49 In the Coty case (see Press Release No. 132/17 Luxembourg, December 6, 2017, Judgment in Case C-230/16 Coty Germany GmbH v. Parfumerie Akzente GmbH), the European Court of Justice concluded that market competition in online commerce is multidimensional and apart from the price component there are other relevant dimensions such as product quality and brand image.

50 Veugelers and Petropoulos looked again at this issue in 2018 with the objective to update this study, but did not observe any significant shift in merger analysis toward its impact on innovation that would justify an updated study.

satisfies incentive compatibility) about what platforms would attract their attention if a specific platform were no longer available.

For the impact of the merger on concentration where positive prices are used to clear the market (e.g. advertisers and external suppliers), more traditional tools in merger simulation can be applied.

Closely substitutable platform services can potentially lead to a future competitive equilibrium with direct welfare implications for the merger case. Besides, as already discussed, specific platforms have developed marketing strategies to monitor the development of firms that may be a future threat to their market position.

Putting the insights of online experiments discussed above into steps to assess dynamic M&A effects, consider a merger between a platform A and a firm B. The first question to ask online users is what platform or firm they would use if platform A were not available, for a specific relevant service. At the same time, they should analyze user traffic and how it evolves over time both for platform A and firm B. If, for example, authorities observe that there is a tendency for users to view firm B as an alternative to platform A's core services and that this tendency is increasing over time, then, even if platform A and firm B do not currently operate in the same market, or if they do not currently offer closely substitutable services, they are more likely to become competitors in the future. Obviously, it only makes sense to run such an experiment in the case that firm B has a sufficient installed base of users (namely, the case at which the reversal of the burden of proof in proposal 3 applies). But, this is exactly the case, where avoiding potential competition through a merger can be socially harmful.

Authorities could even go one step further by running a modified small but significant and non-transitory increase in price (m-SSNIP) test on the zero price side of the market to assess the relevant market and whether platform A and firm B are competitors in the eyes of their users. Note that authorities can run an experiment where they ask online users how much reward they would like to be paid in order not to use platform A over a specific time interval. A follow-up question would also include firm B, so the user will neither use the platform nor the firm, if she accepts the monetary amount offered to her. The experiment can be designed such that it can be implemented in an incentive compatible way that reveals the truthful valuation of users following the methodology mentioned above. The m-SSNIP test then could be based on identifying the reward elasticity of users on moving away from platform A. A traditional SSNIP test could be applied on the other side of the market when positive prices apply to the business users (e.g. advertisers).

So, by bringing insights from online experiments we can

- assess whether merged entities are competitors or potential competitors,
- establish a measure of the relevant market when zero prices impose difficulties for the application of traditional tests, and
- capture the value of network effects and their implications of competition.[51]

At the same time, we should strengthen the ex post evaluation of merger analysis for large platforms to better understand the validity of analysis at the time of the merger and whether the proposed remedies are the appropriate ones. Mistakes in this analysis should receive particular attention and have a didactic function when the same platform comes forward with a notification of its next merger.

We should be ready to impose remedies that are contingent on specific future outcomes.[52] If it becomes clear that the remedies attached to the past approval of a merger do not have the desired effects, there should be flexibility such that remedies could be modified accordingly. It would be helpful if remedies are periodically reviewed to assess whether they have the desired effect and are then revised or updated. The specific targets in terms of the welfare impact of a merger as well as

51 See, for example, the online experiment by Benzell and Collis (2021).

52 The Waze acquisition by Google discussed above is a good example of why we need this. As over time Waze functionalities have been integrated into Google's infrastructure, a remedy that prohibits Google from foreclosing rivals from accessing Waze functionalities needs to be adopted.

authorities' concerns should be clearly communicated at the time of the approval of the merger. Remedies should be flexible to change in order to ensure that the specific targets are reached, if needed.

The DMA in its current form increases the investigative powers of the EU competition authorities which will be able to access data and the algorithmic codes of the gatekeepers. The EU competition agency is basically transformed to an embedded regulator with direct access to information related to the business model and infrastructure of the gatekeeper. Without any doubt, these provisions can help the authorities to better understand digital ecosystems and assess more accurately the impact of mergers and their potential anticompetitive effects. Specific attention should be given to the implementation of these proposals, so that the EU authorities will be able to extract useful and up-to-date information for their analysis.

6. Potential limitations of policy proposals and how we can address them

The foregoing proposals are not without limitations, which may require further action in order to deliver the best results. We discuss these below.

Proposal 1 requires the establishment of standards that would enable information sharing. Standardizing APIs, for example, would help companies develop technical means of accessing data located on platform infrastructure. In the absence of such standards, platforms may find ways to avoid sharing information by making it technically difficult for firms to access their infrastructure. In the absence of standards, markets can also fragment with each platform adopting different protocols. This means that entering firms could face data access hurdles. High levels of data fragmentation could discourage firms from participating in the proposed in situ mechanism. This effect could be especially pronounced for smaller firms. Even if the ex ante regulation incorporates some minimum standards, as argued above, incumbent platforms will have incentives to add friction to third-party data access in order to continue the benefits of their information advantage. Establishment of consortia to set and enforce standards can help (Cusumano *et al.*, forthcoming). Establishment of an efficient reporting mechanism can also help competition authorities intervene when platforms artificially restrict access to their infrastructure.

Proposal 2 may require close collaboration between authorities and platforms in edge cases so that authorities can access platform's infrastructure. This raises the risk of regulatory capture, which can bias enforcement and favor the platform (Laffont and Tirole, 1991). Such capture has been observed in industries from aviation, to financial services, to offshore energy exploration and production. One way to avoid this possibility is to establish a regular rotation interval for the authority staff involved in this process. Another way is to enforce sufficient transparency that competitors, whose expertise and interests do not favor the platform, can themselves report on transgressions.

Proposal 3, which describes the reversal of the burden of proof for a limited number of horizontal mergers, requires a clear distinction between horizontal and vertical mergers. This is not easy in every case as the Google–Waze merger example illustrates. A potential misclassification of a merger could undermine the efficacy of proposals 2 and 3. This is exactly why, as we argue in proposal 4, merger remedies should not be fixed in time, but rather should be time flexible and include contingencies over potential market outcomes in the post-merger period. If a merger changes categories from one condition to another, the stricter condition with a possible penalty should apply. A platform so notified of this contingency is less likely to game the rules.

Implementing these proposals requires acknowledging these limitations and enumerating the contingencies such that they might be addressed successfully.

7. Conclusions

Merger and acquisition strategies by big tech companies have substantially contributed to their development and growth. They are a vital part of business activities. Acquisitions provide opportunities for big platforms to expand their business models horizontally and vertically as well as to establish their presence in the core markets of operation.

The emergence of some very large platforms that act as gatekeepers in digital ecosystems have generated concerns over their acquisition strategies and their potential anticompetitive effects.

These concerns have as a basis not only reduced market competition but also potential consumer harm.

As platforms operate multi-sided markets, it is important to not only study the direct impact of mergers on consumers but to also assess the impact of the merger on the other sides of the ecosystem. This arises because the different sides of the platform market are interlinked. Consumers can be affected indirectly when the producer side is altered by the platform merger. The converse is also true as producers can be affected by changed access to consumers.

Competition concerns in digital ecosystems have not been addressed at a satisfactory level by the current enforcement framework. There are a number of reasons including differences in organizational structure and also differences in non-rival resources. There is a significant information asymmetry between the competition authorities and large platforms. The information and expertise gap makes it more challenging to assess the effects of mergers within the strict time frame of merger regulation. In addition, while we have seen a large number of platform acquisitions take place in the last 20 years, only a very small number have been investigated. This suggests an underenforcement and a lost opportunity to better understand the market forces in these ecosystems through merger analysis.

If the current framework is not adequate, then how can we reform it in order to be more effective? Our approach relies on four proposals that deal both with merger policy and its enforcement. Specifically, we have proposed (i) a new ex ante regulatory framework based on new in situ data rights, (ii) a mechanism to investigate vertical acquisitions based on the end-to-end principle and a means to establish equivalence of access, (iii) an update of the conditions under which the notification of mergers should be compulsory and the burden of proof should be reversed, and (iv) an update of competition enforcement tools to increase visibility into market data and trends.

Our position is that we need an effective combination of ex ante regulation and merger control in order to address the competition concerns in digital platform ecosystems. Our priority should be to reduce the information asymmetries in digital markets. We should enable the smaller players of the ecosystem to access valuable information that can help them to compete more efficiently in the platform market. More symmetric information across the participants of the ecosystem will make it more difficult for the platforms to leverage their market power and will reduce their incentives to engage in anticompetitive acquisitions. Broader information access should also allow third parties to also create value from a nonrival resource. At the same time, authorities should be more proactive in studying these acquisitions and should update their approach by considering new online tools and methodologies for assessing the potential impact of merger cases. This requires consideration of multiple feasible future ownership possibilities, not just the one the platform seeks.

Creating more competitive and innovative digital ecosystems can have important benefits for all market participants. To do that, we need first to ensure that the value created in these ecosystems is not negatively affected by the necessary policy changes. The primary objective of the policy recommendations should be to create value and, at the same time, redistribute this value in a fairer way with an emphasis on improving multi-party welfare.

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