



2020/01

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Axel Gautier and Joe Lamesch

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## **CORE**

Voie du Roman Pays 34, L1.03.01

B-1348 Louvain-la-Neuve

Tel (32 10) 47 43 04

Email: [immaq-library@uclouvain.be](mailto:immaq-library@uclouvain.be)

[https://uclouvain.be/en/research-institutes/  
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# Mergers in the Digital Economy\*

Axel Gautier <sup>†</sup>& Joe Lamesch <sup>‡</sup>

January 13, 2020

## Abstract

Over the period 2015-2017, the five giant technologically leading firms, Google, Amazon, Facebook, Amazon and Microsoft (GAFAM) acquired 175 companies, from small start-ups to billion dollar deals. By investigating this intense M&A, this paper ambitions a better understanding of the Big Five's strategies. To do so, we identify 6 different user groups gravitating around these multi-sided companies along with each company's most important market segments. We then track their mergers and acquisitions and match them with the segments. This exercise shows that these five firms use M&A activity mostly to strengthen their core market segments but rarely to expand their activities into new ones. Furthermore, most of the acquired products are shut down post acquisition, which suggests that GAFAM mainly acquire firm's assets (functionality, technology, talent or IP) to integrate them in their ecosystem rather than the products and users themselves. For these tech giants, therefore, acquisition appears to be a substitute for in-house R&D. Finally, from our check for possible "killer acquisitions", it appears that just a single one in our sample could potentially be qualified as such.

**Keywords:** Mergers, GAFAM, platform, digital markets, competition policy, killer acquisition

**JEL Codes:** D43, K21, L40, L86, G34

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\*The authors would like to thank M. Bourreau, N. Dürr, L. Madio and N. Petit for useful comments and suggestions and I. Peere for editing assistance.

<sup>†</sup>HEC Liege Management School, University of Liege, LCII. Other affiliations: CORE and CESifo. Email: [agautier@uliege.be](mailto:agautier@uliege.be)

<sup>‡</sup>HEC Liege Management School, University of Liege, LCII. Email: [joe.lamesch@uliege.be](mailto:joe.lamesch@uliege.be)

# 1 Introduction

The five largest tech giants, Apple, Alphabet (Google), Amazon, Facebook and Microsoft, known as GAFAM, are among the largest market capitalization firms worldwide. Operating as multi-sided platforms, they have created a large ecosystem of products, applications, services, content and users. They create value by offering services to the various user groups gravitating around the platform and by enabling interaction between and within them.

GAFAM has known tremendous growth, both internal and external, over the last two decades. Its investment in research and development is huge with a cumulated investment of over \$ 71 billion for the year 2017. In addition to these important investments, GAFAM has an extremely intense mergers and acquisitions (M&A) activity. In 2017, for instance, they have altogether made 55 (different) acquisitions. Most of these, appear to be young and innovative start-ups.

There are several reasons for one of the GAFAM platforms to acquire an innovative startup. First, the platform might be interested in the products developed by the startup. The GAFAM have developed a large ecosystem of products and services and are more and more competing for attention, i.e. to retain consumers on their platform (Prat and Valletti, 2019). In this context, adding new products or functionalities is part of the competitive process, acquisition therefore is one way of developing the firm’s ecosystem. Second, the platform might be interested in the startup’s input. This indeed has valuable assets (innovation, patent, engineer, talent, customer base) that could be of interest to the platform. Last, acquisition may be a way of restricting competition and consolidating the platform’s position on the market.<sup>1</sup> As, in the digital economy, an important source of value comes from network effects, a firm with a substantial user base can eventually turn into a competitor of the incumbent network even if there is at the time no product overlap (Cremer *et al.*, 2019). Hence, the acquisition of a small and promising startup can be used to restrict potential competition on the market. Nowadays, there are growing fears that the GAFAM acquire startups to protect their already strong market position. This type of merger is now referred to as a killer merger: the firm acquires a target which develops a technology that can be used to compete with its own products in the future and the acquisition kills the competitive threat.<sup>2</sup>

Despite their intense merger activities and the vivid debates they generate, little is known about the the GAFAM’s merger strategies.<sup>3</sup> The present research ambitions to fill this gap. To this end, we have collected detailed information on the 175 M&A of the GAFAM over the years 2015-2017 and on the GAFAM themselves. We have extracted all the necessary information from the 10-k files of the GAFAM<sup>4</sup> and the Crunchbase database<sup>5</sup>.

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<sup>1</sup>These motivations echo the classical distinction in the industrial organisation literature between conglomerate, vertical and horizontal mergers. A horizontal merger refers to an acquisition in the same market; a vertical merger, to an acquisition in the same supply chain; and a conglomerate merger, to an acquisition in a new market. Horizontal and vertical mergers raise competitive concerns as they reduce market competition or create a risk of vertical foreclosure respectively, whereas conglomerate mergers usually raise much less competitive concerns.

<sup>2</sup>Cunningham et al. (2018) collect data on acquisition in the pharmaceutical industry. They document that 6% acquisitions are killer acquisitions, where the acquiring firm buys a target developing a drug similar to its own and later stops the development of the target’s product.

<sup>3</sup>This paper focuses on the five largest tech companies by market capitalization, Google, Amazon, Facebook, Apple and Microsoft. We have two reasons for focusing on these five firms. The first is that they are the most active tech firms in terms of acquisition: over the years 2015-2017, they acquired a total of 175 firms. (Of the five, though, Facebook proved the least active with just 20 acquisitions.) Tech firms other than these appear to be less inclined to rely on such transactions. Over the same period, Twitter undertook 11 acquisitions, AirBnB 10, Uber 5 and Netflix only 1. The same holds for Asian tech companies: Alibaba acquired 12, Rakuten 6, Tencent 5 and Baidu 4. The second reason for focusing on the GAFAM is that acquisitions made by them received much more attention given their strong market position and growing fears that mergers by them be used to strengthen their market power.

<sup>4</sup><https://www.sec.gov/fast-answers/answersreada10khtm.html>

<sup>5</sup><https://www.crunchbase.com/>

We focus on three main research questions. First, we investigate whether firms acquire others to reinforce their current business model or to enter new markets. Second, we look at what firms do acquire: the target firm’s products and users or assets (functionality, technology, IP, human capital). Last, we use the collected information to check for possible killer acquisitions in the digital economy.

The GAFAM firms are at the center of an ecosystem of products and services and they are competing on multiple markets. All, however, have one or several core businesses. Acquisitions could be used to strengthen their core business segment or to enter new segments. In the former case, an acquisition reinforces the platform’s market position; in the latter, it increases global competition between firms. We examine whether M&A take place in their core segments or in new ones. Our objective is to depart from the traditional distinction between horizontal, vertical and conglomerate mergers based on relatively narrow market definitions and to propose a classification of acquisitions based on user groups.

To look into this question, we proceed in two steps. First, we identify each GAFAM firm’s most important market segments. We broadly define the segments according to the group of customers targeted. Six different user segments are identified: products offered to advertisers, businesses, consumers, merchants, content editors and platform products (mainly hardware and operating systems). For each of the GAFAM, we use the 10-K reports to determine in which user segments it is active.

We then, as far as possible, try to match information on revenue streams with the corresponding user segments. Given their multi-sided nature, some segments do not directly generate revenues for the platform. For instance, Facebook does not directly collect revenues from users. However, matching revenue with segments is important to identify the revenue or the money side of the platform. For all the GAFAM, the revenue streams are extremely concentrated with most of the revenues coming from one or two segments: platform products (devices) for Apple, merchants for Amazon, advertising for Facebook and Google, business and platform products for Microsoft.

In a second step, we classify acquisitions and allocate each to one of the six business segments. Contrary to competition authorities, who have a narrow market definition, usually by product type, we classify mergers, whenever possible, by identifying the targeted customer group of the acquired firm. This broader picture of GAFAM acquisitions allows us to determine whether the big five use M&A mainly as an instrument to strengthen their core segments or enter new ones with the view of diversifying. While the resulting classification does not allow us to assess the pro and anti competitive effects of these acquisitions, it provides insights about the GAFAM’s M&A strategy.

Our classification reveals the following: most acquisitions are undertaken in segments in which the GAFAM firms were already active. According to our classifications, around 36 % of the acquisitions are in the acquiring firm’s main business segment and around 82% occur in segments in which the firms were already active. This suggests that these firms are using their M&A activity mostly to strengthen their current business models, and do not seek to increase direct competition between them by entering new markets.

There are, however, two exceptions to these findings. The first one concerns the segment of products for business customers, in which Microsoft, Amazon, Google and Apple have acquired substantially. This could be a sign of increasing rivalry between them for these customers, given that Google and Amazon clearly want to compete with the current market leader, Microsoft. The second exception is Google. Compared to the other four firms, Google not only acquired the most in absolute terms, but did so in all six segments, including those in which it was not extremely active yet. Hence, Google appears to have a more aggressive M&A strategy and to intend to compete with all firms in most segments.

We further analyze the acquisition strategies of the GAFAM firms by looking at the evolution of the target post-acquisition. We observe that in the vast majority of cases, the acquired brands

are discontinued by the acquirer. A product is considered to be discontinued if it is no longer supplied, maintained or upgraded under its original brand name. We observe that in 60% of the acquisitions, the acquired products were discontinued. The product remains supplied under its original brand name in 27% of the acquisition cases.<sup>6</sup>

Product discontinuation reveals important insights into the reasons for acquisition. Firms can be acquired for their products and customers or for their assets and their R&D efforts (Puranam and Srikanthfor, 2007). In the former case, the product is likely to be maintained under its original brand name while in the latter case, the product is likely to be integrated in the firm’s ecosystem. Hence, mergers motivated by asset acquisition are more likely to be discontinued.

We run Probit regressions to better understand the determinants of product discontinuation. We find that younger firms and those in the core business segment of the acquirer are more likely to be discontinued. This suggests that most acquisitions are undertaken to reinforce the firms’ innovation efforts by purchasing R&D efforts and talents or to add functionalities to their core products. Again, this could be a sign that acquisitions are used to reinforce a business model rather than to develop competition. We also find that Apple and Facebook have a more systematic discontinuation policy.

Finally, we take a closer look at killer acquisitions. In the pharmaceutical industry, Cunningham et al. (2018) identify killer mergers in which the acquiring firm shuts down the target because it is directly competing with its own products or R&D efforts. In the digital economy, a large user base is an important asset and a firm which has managed to create a large network can easily extend its product space and compete with the incumbent network. However, because of network effects and switching costs, the acquired firm will likely continue to operate under its initial brand name. Keeping the product under its original name is a way of preserving the user base while integrating it in a larger ecosystem. Besides, it is not in the interest of the platform to do so if the user bases overlap (Prat and Valletti, 2019). Hence, in the digital economy, contrary to the pharmaceutical industry, a killer merger would not necessarily lead to the discontinuation of the product’s brand. Rather, if the product’s value is based on its user basis, the opposite should be observed.

Based on the preceding discussion, we try to identify potential mergers in the killer zone by looking at acquisitions that satisfy the following three conditions. They should be (1) in the core segment of the acquirer, (2) continued under the original brand name after acquisition and (3) have a substantial user base. On the basis of these criteria, we found only one potential killer merger: Facebook’s acquisition in 2016 of Masquerade, a young startup that had developed a photo filter app that became rapidly popular.

Our analysis leads us to conclude that most of the acquisitions made over the period considered were driven by asset acquisitions. Firms buy valuable innovations, functionalities or R&D to strengthen their main segments. By doing so, they improve their products’ ecosystem and reinforce their position in their already strong market positions. We find no evidence that this intense M&A activity leads to more global competition between the GAFAM firms. Finally, we find no evidence in our sample that killer mergers are widespread, but just one potential case that would have deserved closer investigation by competition watchdogs.

The intense M&A activity of the main digital platforms raises specific policy concern, especially regarding the possible inadequacy of merger control instruments. Competition authorities have the power to block an anticompetitive merger. Yet, despite their intense merger activities, few of the GAFAM’s acquisitions were scrutinized by antitrust authorities and, currently, there are growing fears that anti-competitive mergers fly under the antitrust radar.

Two main reasons account for such fear. First, the target firm is often too small and its revenue usually falls below the usual threshold for investigation.<sup>7</sup> There are exceptions

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<sup>6</sup>We lack information for 13% acquisitions.

<sup>7</sup>Germany and Austria have recently modified their notification thresholds, including a reference to the value

though. For instance, the mergers between Apple/Shazam (2018) Microsoft/LinkedIn (2016), Facebook/WhatsApp (2014) and Google/DoubleClick (2008) were all approved by the European Commission, and so were the mergers between Facebook/Instagram (2012) and Google/Waze (2013) by the OFT. Nevertheless, most of the acquisitions by the GAFAM are not scrutinized by competition authorities.<sup>8</sup>

Second, the acquired start-ups develop products and services that do not overlap with the narrowly defined market in which the acquiring firm has a dominant position. For this reason, most acquisitions could be classified as conglomerate mergers and, as such, raise fewer competitive concerns. However, a successful start-up may rapidly turn to a competitor of the dominant platform. This is particularly true if the firm has managed to rapidly acquire a large user base. Indeed, even if there is no obvious overlapping between products, the firm can extend its products bundle and, with a sizable user group, turn to a significant competitor of the installed platform. In this case, the acquisition of the firm by the dominant firm may substantially reduce (potential) competition on the market. However, as there is a lot of uncertainty surrounding the competitive potential of the startup, the anticompetitive effects of a proposed merger might be difficult to assess ex-ante as it is notably complicated to construct an appropriate counterfactual against which the effects of the merger should be appreciated. There is the risk of a false negative – clearing an anticompetitive merger–. Several scholars consider that competition authorities have underestimated that risk in their assessments (see Argentesi *et al.*, 2019) and that not only the risk but the cost of a type-II error should be considered (Bourreau and de Strel, 2019).

For these reasons, several recent high-profile reports from both sides of the Atlantic<sup>9</sup> propose reforms of the merger assessment procedure. The possible reforms include firstly, a revision of the notification thresholds to be taken into account, e.g. the transaction value, the number of affiliated users or other criteria. A change in the notification threshold is necessary to give competition authorities the opportunity to scrutinize the acquisition by a large platform of a small start-up.<sup>10</sup> Secondly, they propose to change the balance of risk to give more importance to the potential competition exerted by the target on the acquiring platform, even if there is a lot of uncertainty surrounding future market evolutions. For the moment, a highly uncertain potential competition is balanced with the most likely efficiency effects. In the merger assessment, it is proposed to give more importance to the former and less importance to the latter. Last, a reversal of the burden of proof is suggested. In this case and in specific circumstances, it is up to the acquiring firm to demonstrate that the proposed acquisition has pro-competitive effects rather than to the competition authority to demonstrate that the mergers have a negative impact on the market.

### Related literature

We now review the literature on mergers in the digital economy. There is, to our knowledge, no systematic analysis of the merger activity of the main digital platforms, except for the report by Argentesi *et al.* (2019). This makes a critical assessment of several merger decisions taken by the Competition Market Authority (UK) in the digital economy, and suggests reforms to take better account of the specificities of digital markets.

Few papers explicitly consider the striking features of the digital economy in a merger model. Motta and Peitz (2020) develop a model of acquisition by big tech firms. In their set-up, the startup (the target) is potentially financially constrained and may lack of the necessary resources to complete its innovative project. Acquisition by a less financially constrained big tech may remove this financial constraint and brings the new project to an end. Acquisition

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of the transaction.

<sup>8</sup>In August 2019, the FTC started to investigate the motivations for the acquisitions of Instagram and WhatsApp by Facebook. <https://on.wsj.com/2L88h2D>

<sup>9</sup>Argentesi *et al.* (2019), Bourreau and de Strel (2019), Cremer *et al.* (2019), Scott-Morton *et al.* (2019)

<sup>10</sup>Wollmann (2019) shows that higher thresholds are detrimental to competition as they lead to a substantial increase in (unscrutinized) mergers, especially horizontal ones between competitors.

has however two drawbacks. First, the big tech may acquire the startup and stop the project (a killer acquisition). Second, acquisition could occur despite the fact that the startup has enough resource. In this case, the innovative project would be developed when the startup remains independent and acquisition only reduces competition on the market. Finally, Motta and Peitz develop, based on their modeling, theories of harm that integrate specific features of the digital economy like zero-price products or network effects.

Prat and Valletti (2019) develop a model of attention oligopoly in which platforms that may *a priori* look like different are competing with each other for the attention of the targeted consumers, attention that will be sold to the advertisers and retailers. In this context, they consider a merger between two competing networks and they show that the larger the overlap between the user bases, the larger the welfare losses resulting from the merger, i.e. a merger between overlapping networks is more detrimental than a merger from dissociated networks. Hence, a merger between two networks offering different products to the same user groups can be used to substantially restrict competition on the market, even if the products offered to capture consumer attention are different.

Cabral (2018) develops a model where tech giants are competing with fringe firms. The focus of the model is on innovation and the impact of mergers on incentives to innovate.<sup>11</sup> Cabral distinguishes radical from incremental innovations, showing that mergers favors incremental innovation but decreases radical innovation. The idea is that incremental innovation has more value if it is transferred to the dominant firm and a merger is a way of doing so. Anticipating a transfer, the startup partially internalizes the full benefit of its innovation and has more incentives to invest. On the contrary, startups have fewer incentives to invest in radical innovations that would allow them to replace the dominant firm. The reason is that increasing the benefit of incremental innovation also increases the opportunity cost of a radical innovation. Therefore, a merger may boost investment yet also reinforce the incumbent's dominance. Bryan and Hovenkamp (2019) reach a similar conclusion. They develop a model of startup acquisitions by dominant firms where startups innovate and develop components to be used by a tech giant. They show that technological leaders have more incentives to buy the startups to maintain their leadership and that this persistence of leadership through acquisition may not be welfare improving. Furthermore, startups may bias their research efforts towards the improvement of the technological leader, and in so doing reinforce its leadership.

Complementarities are important in the digital economy as many startups develop products or features that are complements to the platform's ecosystem. Wen and Zhu (2019) show that the entry threat of the platform in a complementary market changes the incentives to innovate and the the complementor's pricing strategy. Rather than entry, a platform can buy the complementor to expand its ecosystem. Etro (2019) shows that such a merger between complements increases the innovation effort, as it solves the Cournot complement problem but it restricts competition by making entry less likely.

The paper is organized as follows. In Section 2, we present the platform's business model, the users group gravitating around it and the main revenue sources. In Section 3, we provide detailed information on the GAFAM firms' merger activities over 2015-2017. In Section 4, we review each of the GAFAM's M&A activity. In Section 5, we analyse the product continuation decision. In Section 6, we look at potential killer mergers and conclude in Section 7. In the appendices, we describe the data source in greater detail (Appendix A), provide a list of acquisitions (Appendix B) and additional statistics (Appendix C).

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<sup>11</sup>A merger changes the incentives to innovate of both insiders and outsiders to the merger. Several recent papers focus on the impact of mergers on innovation incentives (see for instance Motta and Tarentino, 2017; Federico *et al.*, 2018; Bourreau and Jullien, 2018).

## 2 The GAFAM firms

### 2.1 Multi-sided Platforms

The GAFAM firms are multi-sided platforms enabling interactions and value creation among multiple user groups. They constitute an ecosystem with multiple players gravitating around it. We represent a schematic view of the platform in Figure 1. We identify five different user groups interacting on the platform. Notice that a single entity can play different roles, e.g. it can be both an advertiser and a merchant.

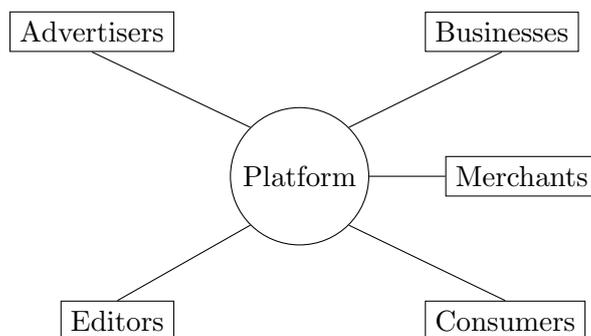


Figure 1: GAFAM as platforms

- **Advertisers:** Use the platform to reach potential clients. They want to place and target online advertising on the internet. Advertisers are corporate firms, organizations or institutions.
- **Businesses:** Use the platform to increase their productivity and their organizational functioning. Business clients use the products and services offered by the platform to increase their own productive or creative processes. Business customers are corporate firms, however, since many of these products are offered in a customer version or on a Freemium basis, some products offered to business users are also available to end-users.
- **Merchants:** Use the platform as an online distribution system. Merchants sell physical goods over the internet. Companies as well as end-users may act as merchants.
- **Content editors:** Create digital content and use the platform to make it accessible to users. Editors need development support and platforms to reach users.<sup>12</sup> Again, both corporate firms as well as end-users may act as content providers and editors.
- **Consumers:** Use digital devices to navigate the internet and its content. Need products and services to access and use the internet. Only end-users act as consumers.
- **Platforms:** Create interaction within and between the various user groups. To do so, the platforms develop a technical architecture to enable interactions and to supply services. These products and services include hardware, operating systems and interfaces which are the platform's technical backbones.

The segments we define regroup products targeting the same user groups. For instance, the segment for advertisers regroups all products and services that allow them to place, serve and target advertising on the internet.

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<sup>12</sup>By digital content, we understand streaming or downloading of music, videos, ebooks or applications. Among content editors we also count online stores for digital content, e.g. an app store, or an ebook store.

As these firms and their products often operate as multi-sided platforms, by nature, they serve more than one single user group. Eventually, each product is meant to link a given user group to end-users: advertising services are meant to link advertisers to potential consumers.

We, however, define each segment based on one user group. We base this allocation of products on the descriptions and explanations provided by the GAFAM firms in their 10-K reports. We thereby ensure the consistent treatment of similar products.

Table 1 shows the six defined segments, the concerned user groups as well as examples of products within each segment.

Table 1: User Groups, Segments and Products

User Group	Segment	Product Examples
Advertisers	<b>Advertising</b>	Advertising networks, auctions, serving technology, targeting services
Businesses	<b>Business</b>	Cloud services, productivity software, collaboration tools, analytics software, CRM and sales software
Merchants	<b>Merchant</b>	shopping websites, delivery services, online payment services
Content Editors and Creators	<b>Content</b>	Development tools for apps, music, videos, or games, online stores for content like app stores, music streaming
Consumers	<b>Consumer</b>	Search engines, web browsers, social media, messengers, map services
Platform	<b>Platform</b>	Devices like smartphones, laptops, other wearables, operating systems and interfaces

## 2.2 Main segments of the GAFAM

Platforms create value by offering products and services designed for each category of users and by enabling interactions between them. In a first step, we identify the segments in which each firm is operating, i.e. the main categories of users they serve.

The classification of economic activities requires full knowledge of tGAFAM ? products and services at a given point in time. To do so, we use the detailed information contained in the 10-K reports. These are written by the five firms themselves and give a complete view of their activities at a given moment. We attempt to categorize the various GAFAM products and services according to the targeted customers. By doing so, we assess which firm is active in which segment. We base this allocation of products on the descriptions and explanations provided by the GAFAM firms in their 10-K reports. We thereby ensure the consistent treatment of similar products. Since we are interested in the acquisitions over 2015-2017, we use the 10-K reports of the year 2014 to classify the GAFAM’s product portfolios and the associated income.

The following table reports the segments in which the firms were active in 2014. This reveals that firms are active in multiple segments but that none in 2014 was serving all of these.

Table 2: Active Segments of the GAFAM, year 2014

Segment	AMZN	APPL	FCBK	GOOG	MSFT
Advertising			✓	✓	✓
Businesses	✓	✓			✓
Merchants	✓	✓			
Content	✓	✓	✓	✓	✓
Consumers		✓	✓	✓	✓
Platform	✓	✓		✓	✓

### 2.3 Revenue sources of the GAFAM

Next we identify the main revenue sources of firms. Our objective is to link revenues to the user segments as far as possible. We label the segment that generates more than half of all revenues as the core segment of that firm.

Two aspects hinder a precise link between segments and revenue streams. First, firms do not represent their revenue information according to the 6 user segments defined above. Worse even, the structure employed varies among firms and over time.

Second, all 5 firms to some extent operate as multi-sided platforms. This role is usually not limited to a single product; rather, the ecosystem of interlinked and connected products offered by each firm acts as a platform for various user groups. As a consequence, the success of a product is not independent from other complementary products within this ecosystem.

What is especially pronounced when one considers Google’s and Facebook’s core segments, is the fact that, contrary to Amazon, Apple and Microsoft, both giants derive little direct revenues from their popular consumer products and services. Since these are often free of charge for end-users, both firms generate revenues by selling users attention to advertisers. Therefore, when identifying core segments, one cannot ignore the consumer side, although the bulk of revenues for both is generated through advertising. For Google and Facebook, therefore, we label both advertisers and consumers as core segments.

This what, naturally, remains an approximation; it cannot be taken as a precise and complete distinction between revenue streams. Rather, this what? serves as an illustrative exercise of the importance of firms’ products and segments.

The following tables (Table 3 to 7) report each firm’s main sources of income for the year 2014. In each table, the right-hand column displays the revenue streams indicated by firms in their 10-K filings as well as their relative importance in terms of total revenues.<sup>13</sup> These are matched with the products generating them in the middle column. The left-hand column indicates the user segment in which these products are assigned. Each firm’s main income segments, i.e. its core segments, are printed in bold.

#### 2.3.1 Amazon

Table 3 reports the revenue streams and the corresponding segments for Amazon in 2014. Amazon derives revenues from the 4 segments where it is active. The company distinguishes two main sources of revenues: those coming from the sales of goods (merchants), media (editors)

<sup>13</sup>For some cases, these revenue streams might be regrouped in order to fit our segmentation.

and the devices it produces (platform), and those from the sales of digital services, mainly cloud services for business. Online sales represent the largest revenue stream, accounting for more than 93% of the generated income. Although these three segments cannot accurately be distinguished, the merchant segment clearly accounts for the vast majority of these revenues. In 2014, the revenues from the Kindle (platform) were about \$ 4 billion (4.4%)<sup>14</sup> and those from Prime were around \$ 2.7 billion (3%).<sup>15</sup>

Table 3: Amazon Products and Revenues (2014)

Segment	Products	Revenues	
		Amount	Share
Merchants	Shopping websites: amazon.com, amazon.fr, etc.; ‘Marketplace’ platform (Online Resale); ‘Fulfillment’ (Delivery Services)	83,391	93.71%
	‘Kindle’ e-readers, ‘Fire’ TVs, ‘Echo’ Speakers		
	‘Prime’ (among other things, access to TV shows and movies); ‘Kindle Store’ (Sale of digital books)		
Business	‘AWS’ Cloud offerings, ‘WorkDocs’ productivity suite, ‘WorkMail’ collaboration tools	5,597	6.29%

Source: Amazon’s 2014 10-K filings, p.27

Amounts in million \$.

### 2.3.2 Apple

Table 4 shows Apple’s revenues. The company is active in five segments, the most important of which is the platform segment. Apple distinguishes the revenues generated by each of its main devices but, as these are all part of the platform segment, we display them together. The sale of these devices generates more than 90% of the income. To increase the value of its devices, Apple offers tools to users and content providers. These segments, which the company identifies as “iTunes, Software and Services”, generate the other revenue streams, mainly from its content stores.

<sup>14</sup><https://www.forbes.com/sites/greatspeculations/2014/04/02/estimating-kindle-e-book-sales-for-amazon/#2903d19f23c6>

<sup>15</sup>10-K filings of 2016, p. 68

Table 4: Apple Products and Revenues (2014)

Segment	Products	Revenues	
		Amount	Share
<b>Platform</b>	'iPhone' phones, 'iPad' tablets; 'Mac' laptops; other devices (watches, keyboards, etc.); 'IOS' operating systems	164,732	90.12%
Content	'AppStore' for mobile application; 'iTunes' for music; 'iBooks' for digital books	18,063	9.88%
Merchants	'ApplePay' mobile payment system		
Business	'iWork' productivity suite		
Customers	'Safari' web browser; 'Facetime', 'Message' communication tools; 'Map' navigation services		

Source: Apple's 2014 10-K filings, p. 27.  
Amounts in million \$.

### 2.3.3 Facebook

Facebook is active in three segments: advertising, content and consumers. By offering tools and service to consumers and editors, the social network generates traffic and monetizes this by advertising. As mentioned earlier, since these ads are sold on its consumer services, we qualify both segments as core. Table 5 shows that in 2014, Facebook's revenues almost entirely came from advertising. A minor part of revenues was generated through the sale of online content (online games) on its social network.

Table 5: Facebook Products and Revenues (2014)

Segment	Products	Revenues	
		Amount	Share
<b>Consumer</b>	'Facebook' social network and messenger; 'WhatsApp' messenger; 'Instagram' social network	0	0%
<b>Advertising</b>	'Audience Network' advertising network; 'Atlas', 'LiveRail'	11,492	92.19%
Content	Offers online content like games through its social network services	974	7.81%

Source: Facebook's 2014 10-K filings, p.43  
Amounts in million \$.

### 2.3.4 Google

Google is active in 4 segments: editors, consumers, advertising, but also the platform segment. Table 6 indicates that the vast majority of its revenues was generated through the sale of advertising for consumers. Given the importance of end-users, not as a source of income but to generate income, we refer to the consumer segment as core.

Products for consumers, editors and the platform itself (mainly Android) aim at generating traffic for advertising. The other revenues were mainly generated by the sale of online content on YouTube and Play Store. Some minor revenues, besides, came from the sale of platform

software and hardware.

Table 6: Google Products and Revenues (2014)

Segment	Products	Revenues	
		Amount	Share
<b>Consumer</b>	'Google' search engine & vertical search engines; 'Google Maps' mapping and navigation services; 'Chrome' browser	0	0%
<b>Advertising</b>	'Ad Words' auctions, 'AdSense' advertising network	59,056	89.48%
Content	development tools; 'YouTube' video platform; 'PlayStore' for books, games, apps	6,945	10.52%
Platform	'Android' mobile operating system; 'Nexus' phones		

Source: Google's 2014 10-K filings, p.45  
Amounts in million \$.

### 2.3.5 Microsoft

Microsoft is active in all segments except the merchant one. The revenue structure is less concentrated with two important segments: the business and the platform. Microsoft's revenue information in table 7 shows that its business products, like cloud services and productivity suites, were its core segment in 2014 generating 57% of the income. The platform software and devices generates 34.5% of the income. The remaining revenues were generated by the sale of development tools for content creators as well as advertising revenues on its Bing search engine.

Table 7: Microsoft Products and Revenues (2014)

Segment	Products	Revenues	
		Amount	Share
<b>Business</b>	'Azure', 'Office 365' Cloud services; 'Excel', 'Word', 'Powerpoint' productivity software'; other business solutions (ERM, CRM)	49,574	57.09%
Platform	'Windows' operating system; 'Surface' laptops; 'Lumia' phones; 'Xbox' gaming console	30,001	34.55%
Content	Development tools for content and game creators	7,258	8.63%
Consumer	'Bing' search engine		
Advertising	Advertising services		

Source: Microsoft's 2014 10-K filings, p.28.  
Amounts in million \$.

### 2.3.6 Revenues and profits of the GAFAM

To sum up, figure 2 displays the five firms' revenue streams for 2014. When multiple segments were responsible for a particular revenue share, the figure represents the most important one. The figure shows that revenues are extremely concentrated. For all firms except Microsoft, there is a single segment generating more than 80% of the revenue. Microsoft has two important

sources of revenues: platform products and the business segment, the latter being the largest income source. Finally, none of these firms generates substantial income directly from the service offered to end-users. Consumers are offered services to generate traffic on the platform and the platforms sell them online content, goods and devices or expose them to advertising.

Differences can be observed in the amount of revenue each of these firms was able to create. Whereas Amazon, Google and Microsoft had somewhat similar revenue amounts, Apple and Facebook had respectively a much higher and a much lower revenue than the others. These differences might reflect the firms' distinct activities (i.e. manufacturing of hardware devices for Apple vs. pure software services for Facebook). Alternatively, they might result from the two companies' age difference.

Finally, it should be noted that revenue is not profit. Some segments may generate high income but low profits or the reverse. It is well documented in the financial press that the contribution to Amazon's profit of AWS is larger than its contribution to income. However, it is not possible to allocate profits to segments as none of the companies publish such information. The following table reports the profit of the GAFAM for the year 2014 in absolute value and relative to revenues. Interestingly, with the exception of Amazon which was making losses in 2014 but has since turned to profits, all the firms have a comparable ratio of profit to income in the range of 20-25%. This huge profitability is another sign of the importance of the GAFAM in the digital economy.

Table 8: GAFAM profits for 2014

Firm	Profit	Share of Revenue
Amazon	-241	-0.27%
Apple	39,510	20.59%
Facebook	2,940	23.52%
Google	13,928	21.10%
Microsoft	22,074	25.43%

Profits in million US\$.

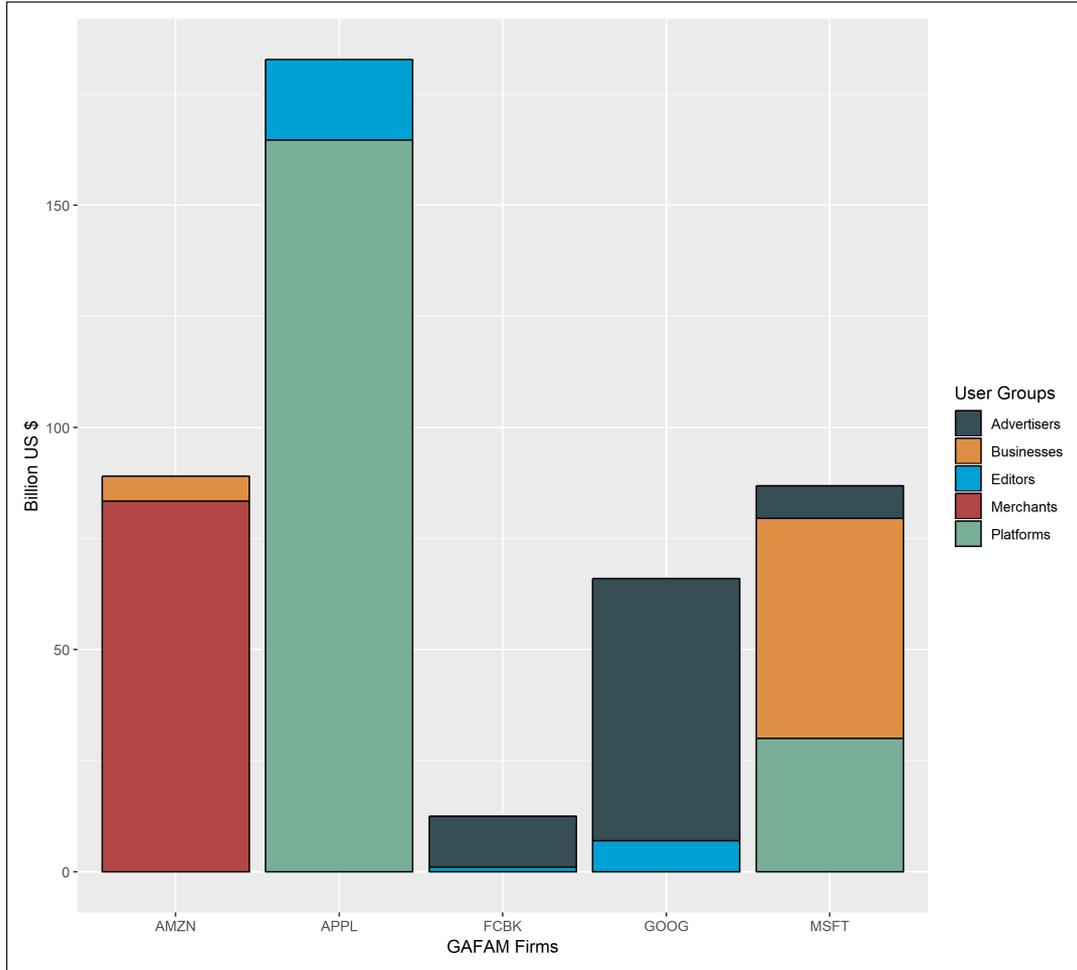


Figure 2: GAFAM Revenues 2014

### 3 Acquisitions Cases

#### 3.1 Overall Summary Statistics

We review 175 acquisition cases for the years 2015, 2016, 2017, the list of which is given in Appendix B. We collect information about these acquisitions as well as the target firms. Table 9 represents some summary statistics about the cases. Further detail is provided in Appendix C.

Panel 9a shows the number of acquisitions in total, per firm and year. Microsoft and Google were by far the most active in terms of number of acquisitions with 52 and 40 cases respectively, Facebook being the least active with 20 acquisitions. In our short sample period, 2015 was the busiest year for these companies, amounting then to 65 acquisitions.

Panel 9b indicates the origin of target companies. We regroup the countries of origin in three classes. Most were located in the United States, 47 were active in the European Union, and 26 in other parts of the world, i.e. Canada, Israel, India.

Panel 9c shows some statistics on the distribution of the target companies' age, their number of funding rounds and the amount of capital raised before being acquired. One can see that the GAFAM firms were mostly buying rather small and young technology companies, with some outliers of more experienced firms. The median acquired firm was aged four, completed two funding rounds and collected \$7 million.

Table 9: Summary Statistics

(a) Number and Years of Acquisitions

	2015	2016	2017	Total:
GOOG	18	20	14	52
MSFT	18	11	11	40
APPL	12	8	13	33
AMZN	9	8	13	30
FCBK	8	8	4	20
Total:	65	55	55	175

(b) Origin of Target Firms

Region	US	EU	Rest of the World	Unknown
No. of Targets	110	30	26	9

(c) Age and funding

	Min.	Median	Mean	Max.	NA's
Age	0.00	4.00	6.09	39.00	1
No. Fund. Rounds	1.00	2.00	2.66	10.00	56
Amount (in thous. US\$)	15.00	7,000.00	23,794.48	460,000.00	72

### 3.2 Classification of acquisitions by segments

In addition to these statistics, we collect information on the target company business and products. Similar to the GAFAM firms' products, we assign each target company a specific segment according to its product and targeted user group. All reviewed acquisition cases with their corresponding classifications are given in appendix. The idea is to match the acquisitions with the segments of the buying firm.

Figure 3 shows our classification of acquisitions by segments. In 19 cases, we are unable to identify a segment for the acquired firm due to unavailable or unclear information. The two most important segments are the *business* one with 61 acquisitions and the *editors* one with 43. By contrast, there are few acquisitions in the *advertising* and the *merchant* segments, with respectively 1 and 5 cases.

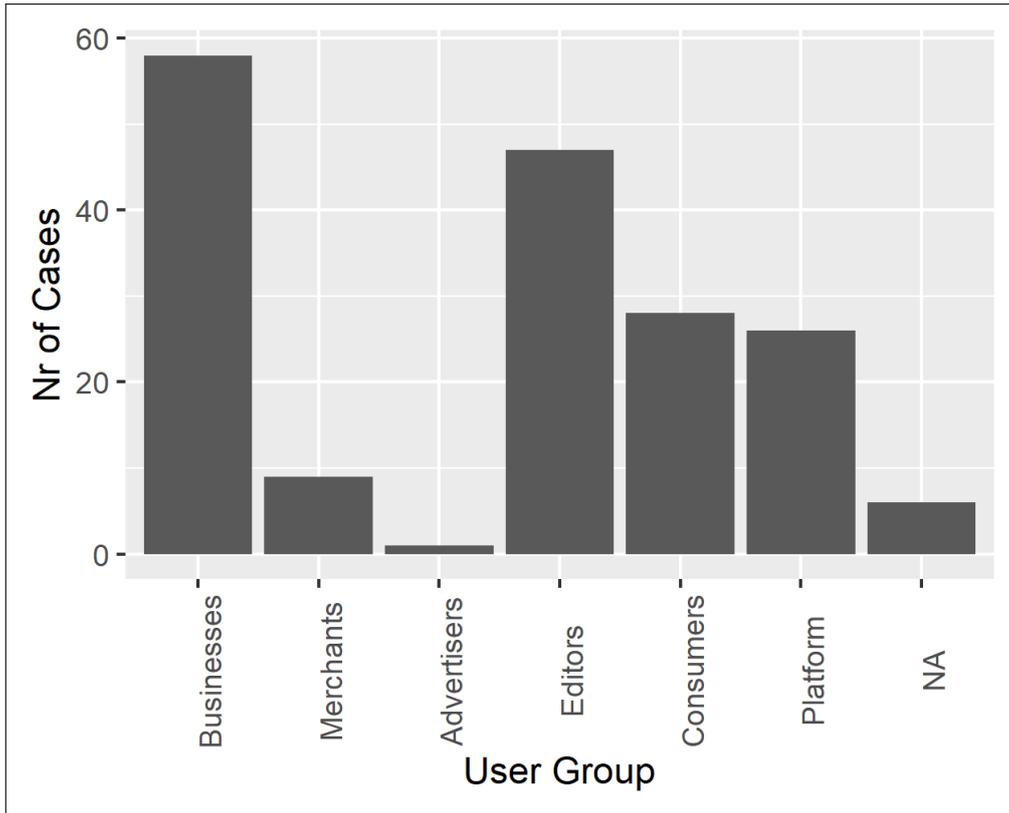


Figure 3: Acquisitions by segment

#### 4 A review of the GAFAM acquisitions

In this section, we take a closer look at the segments in which each GAFAM firm acquired and what kind of companies they have bought. For each firm we display the number of acquisitions per segments. We describe what kind of targets were acquired and how these cases relate to the business descriptions and revenue streams in the 10-K filings of the firms.

## 4.1 Acquisitions by segments

### 4.1.1 Amazon

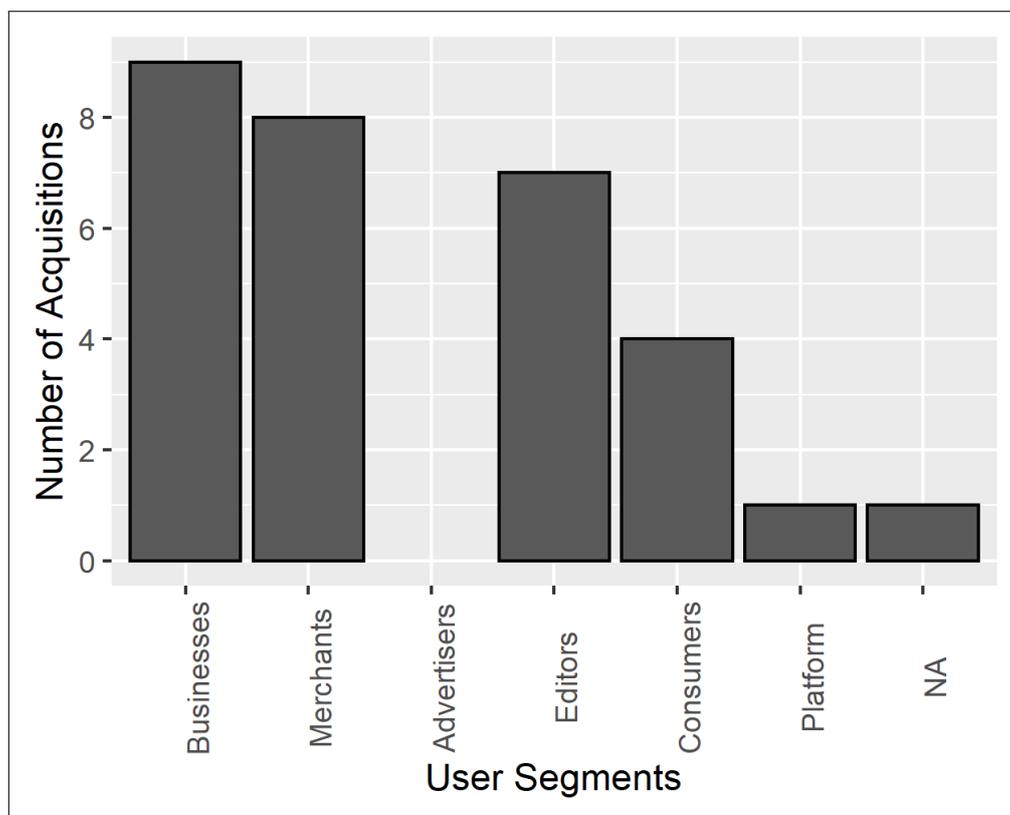


Figure 4: Acquisitions by segments, Amazon

In the period under consideration, Amazon undertook 30 different acquisitions. As can be seen in figure 4, Amazon acquired most in the segments of *businesses*, *merchants* and *editors*. Amazon was already operating successfully in all three segments prior to the start of our period. Segments of less importance to its M&A strategy were *consumers* with four, and *platform* with one acquisition. In one case, targets could not be allocated into a segment.

In the *merchant* segment, Amazon made eight acquisitions. Six aimed at extending the bundle of services provided by purchasing distribution systems, shopping websites and online payment systems. Two of these acquisitions were vertical mergers with brick-and-mortar retail firms. One concerned the take-over of 'Whole Foods', a food chain in the U.S., the other was the purchase of the Indian book publisher and retailer 'Westland'.

There were nine acquisitions in the *business* segment. Acquisitions in this segment concern cloud services as well as productivity software, analytics and cyber security software. Seven acquisitions were undertaken in the segment for *content editors and creators*, most of which are development services for mobile apps, videos and games. Additionally, Amazon acquired an online gaming as well as a video platform. Four acquisitions occurred in the segment for *consumers*, one of which was a personal assistant product. The other three were different search engines, two of which specializing in finding products on the internet and the third one being a search engine for videos. Hence, even if Amazon was not active in this segment yet, these acquisitions seemingly aimed at improving its current products for merchants and content rather than attempting a full grown entry. Last, a single acquisition took place in the *platform* segment; this concerned a manufacturer of security cameras.

Overall these figures reflect a fairly strong focus on the company's already successful product

lines. Besides bolstering its core activity of online shopping, it seems to have further strengthened its online content offerings. Furthermore, the substantial acquisitions in the *business* segment accompanied the considerable revenue growth (from \$5,5 billion in 2014 to \$17,5 billion in 2017) generated by its AWS and business offerings. We can therefore conclude that Amazon used the acquisitions to strengthen its core business and to develop the services offered to the business segment.

#### 4.1.2 Apple

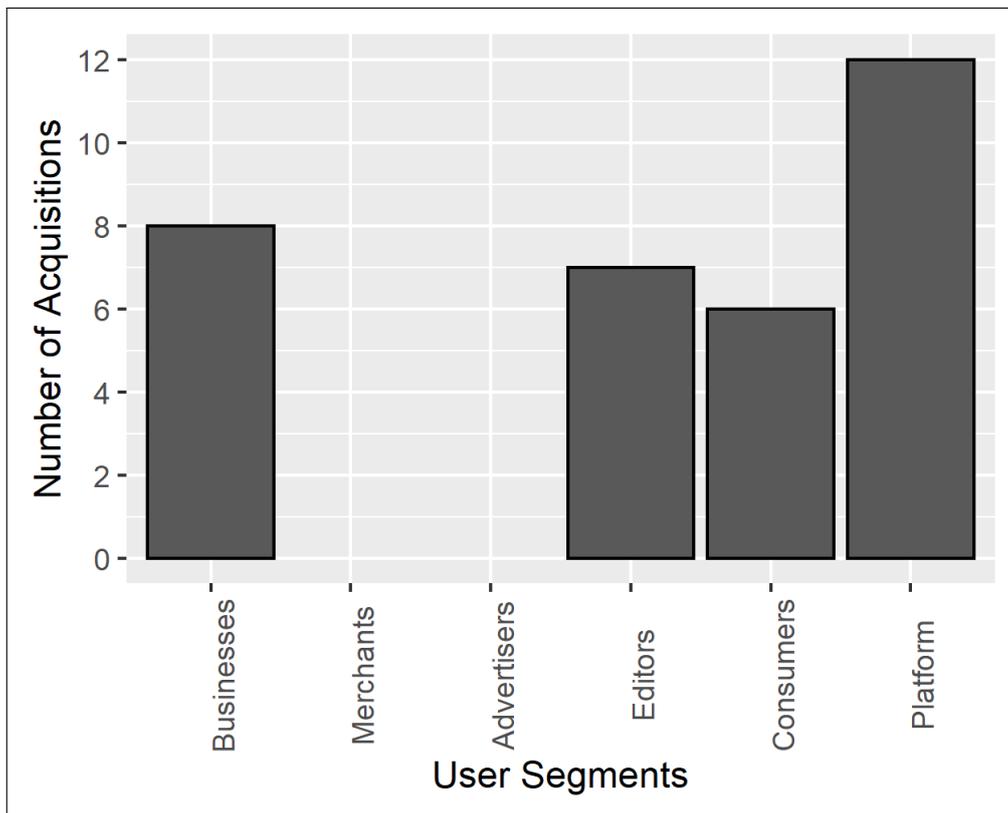


Figure 5: Acquisitions by segments, Apple

Figure 5 shows Apple’s 33 acquisitions. Twelve occurred in the *platform* segment; eight were allocated to the *business* segment; seven to the *editors* and six to the *consumers* segments.

Among the acquisitions in the *platform* segment, which represents its core activity, Apple bought companies developing hardware components such as cameras, semiconductors or wireless chargers. The company also acquired security software for devices, interfaces, such as face recognition and keyboard software, as well as software and hardware technology for virtual reality devices. Of the eight cases in the *business* segment, six are data analytics companies. The cases attributed to the *editors* segment are purchases of development and management tools for music, podcasts and videos. Six acquisitions occurred in the segment for *consumers*; these are navigation and mapping services, health software and a picture editing application. One acquisition concerned the purchase of a social media application specializing in virtual reality images.

The numbers, again, seem to indicate that Apple is using its M&A activity to reinforce its current business model. Platform hard- and software represents its main revenue source as well as the segment in which it acquired most.

Digital content offered by content editors and consumer services constitute a major reason for end-users to purchase Apple’s devices. Acquisitions in the consumers and the editors segments

can be used to improve the features offered on the devices.

The acquisitions in the business segment do not necessarily fit this pattern well, given that products and services for companies and organizations are not among Apple’s main revenue sources. In its 2017 10-K reports, Apple does not mention any increased importance or revenues from these services. Whether these mergers express growing ambitions in this segment or whether the acquired technology in data analytics is meant to be used for other purposes remains unclear.

### 4.1.3 Facebook

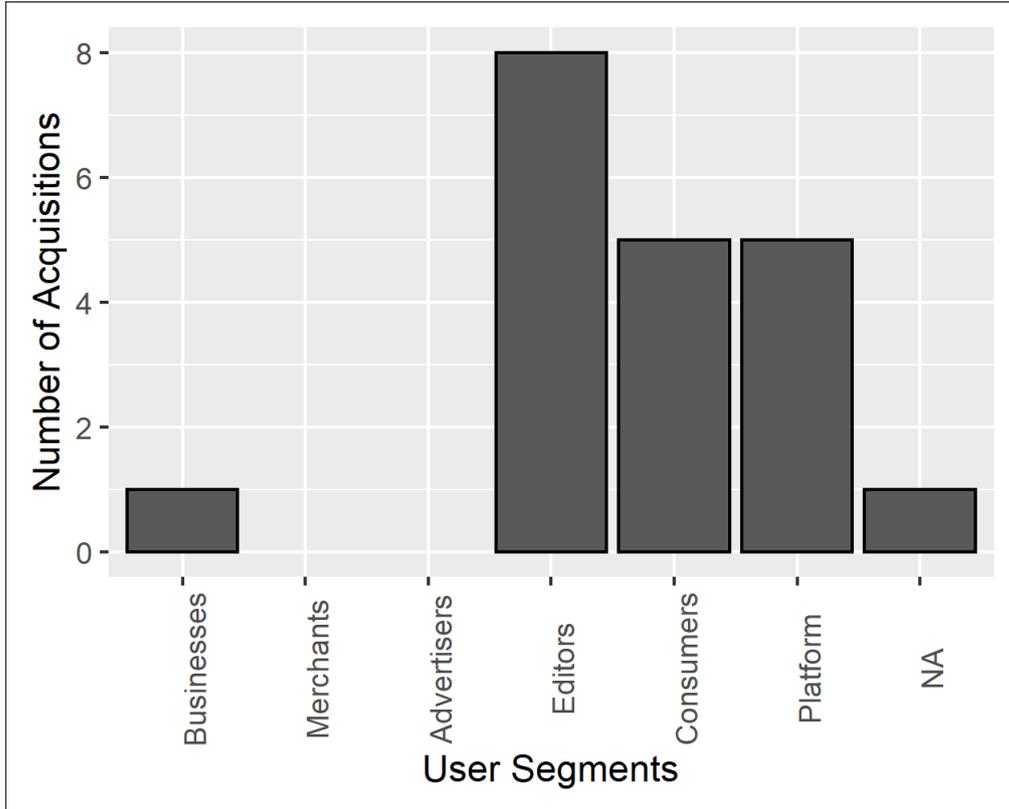


Figure 6: Acquisitions by segments, Facebook

The segments in which Facebook undertook its 20 acquisitions are shown in figure 6. Eight, i.e. the majority, took place in the *editors* segment. Other prominent segments include five for *consumers* and five for *platforms*. A single acquisition took place in the *business* segment. Whereas *editors* and *consumers* are among the regular users of Facebook, *platforms* and *business* services are new to the firm. One acquisition could not be attributed to a segment.

Reflecting its natural core activity, three cases were purchases of social media and sharing applications in the *consumers* segment. Facebook also acquired a target developing personal assistant software. The eight acquisitions in the *editors* segment concern purchases of video streaming technology and content management services for publishers. Moreover, two were purchases of virtual reality and artificial intelligence software for developers. Facebook’s acquisitions in *platforms* were hardware components for virtual reality devices. Finally, by acquiring a customer relations software, the company undertook a single acquisition in the *business* segment.

The classification of Facebook’s acquisitions according to segments reveals that it used its M&A activity for two reasons. First, by acquiring in consumer services, mostly social media apps, its strengthened the non-money side of its core business. Furthermore, the acquisitions in

the services for content editors and providers can be seen in a close relation to the attractiveness of its social services. The acquired technology facilitates the provision of content via its social networks. By providing more content on its social networks, Facebook keeps the consumers within its ecosystem and it can monetize the time spent on the platform.

A second motivation for its acquisitions lies in Facebook’s move into VR hardware and software.<sup>16</sup> This constitutes an entry into a new segment for the firm, which so far neither developed, manufactured or sold any platform devices. Facebook wants to position itself as the leader in VR but this new form of connectivity can be an attempt to generate additional traffic on its platform.

#### 4.1.4 Google

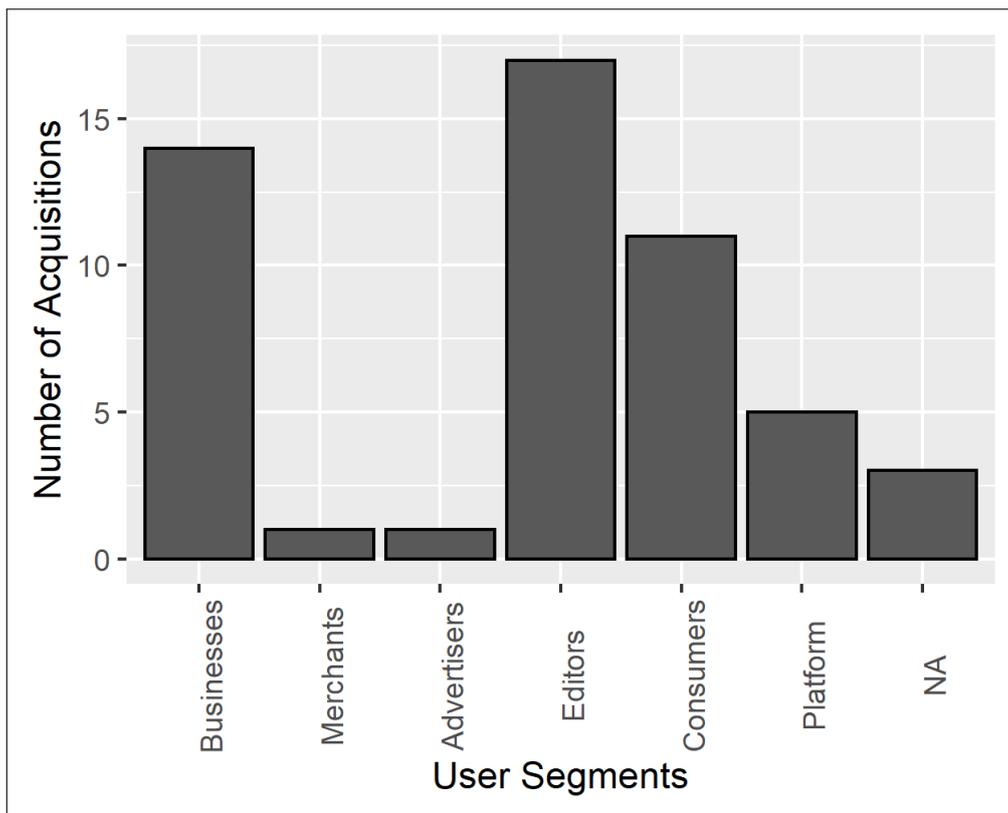


Figure 7: Acquisitions by segments, Google

Google’s 52 acquisitions represent the broadest M&A activity as it undertook transactions in all six segments shown in figure 7. Most of these segments are well known to Google. Those are the segments of *advertisers*, *editors*, *consumers* and *platforms*, with 1, 17, 11 and 5 cases respectively.

However, acquisitions in *merchants* (one case), and especially *business* (14 cases), represent new forms of activity for Google.

Acquisitions in services for *advertisers* as well as the 11 acquisitions in the *consumers* segment can be seen as investments in its most important fields of activities. These *consumer* cases are mapping and navigation services, photo editing and storage software as well as web browser add-ons. Two cases within this segment are purchases of social media apps. Within the *editors* segment, nine cases are development tools for mobile applications and monetization services for content providers. In the same segment, four cases are purchases of game developers, a podcast

<sup>16</sup>An evolution launched through M&A activity by Facebook’s 2014 acquisition of ‘Oculus’.

platform and an ebook online shop. The 14 acquisitions in the *business* segment are purchases of cloud services, productivity software and professional communication products. In the *platform* segment, the company acquired an operating system software, hardware technology and a VR interface software. A single one of its acquisitions took place in the *merchants* segment where it acquired a mobile payment system. However, this application can be used by other user groups.

This broad M&A strategy might suggest vast ambitions. Indeed, like Facebook, Google seems to consider mergers not only as a means of supporting its main activities and products; its 12 acquisitions in consumer and advertising services are clearly meant to bolster its main source of revenue. Similarly, the 17 mergers with content editors or acquisitions of services for them reflect the importance of content and applications available through its online services and Android platform. However, the 14 acquisitions in the business segment represent an attempt of entry into a new segment. Though not yet generating important revenue streams, these acquisitions appear to have contributed to the rapid setup of productivity suites, cloud services and other products for corporate customers.

#### 4.1.5 Microsoft

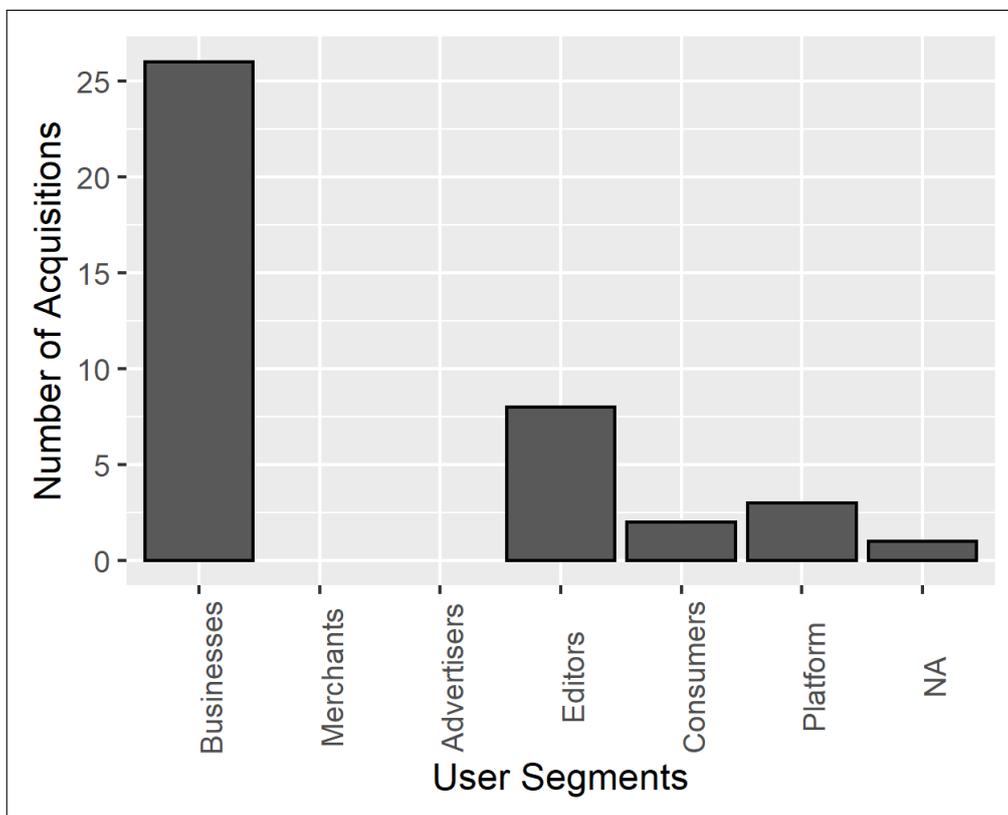


Figure 8: Acquisitions by segments, Microsoft

With 40 acquisitions, Microsoft was the most active in terms of quantity. The segments in which these acquisitions were made are shown in figure 8. The company undertook by far most of its acquisitions in the *business* segment. 26 cases fall within this segment. For the rest, cases occurred in the segments for *editors*, *consumers* and the *platform* segment.

The cases in the *business* segment are purchases of cloud services, productivity software, management software like CRM or sales software, analytics technology and professional communication products. Of the eight cases in the *editors* segment, most concern development tools for applications and games. Other cases are purchases of game content, a gaming streaming

platform and music streaming platform. The three acquisitions in *platform* technology are keyboard software and device accessories. Finally, the two cases in the *consumer* segment concern the acquisition of a virtual reality social network and a picture sharing application.

Microsoft’s purpose of M&A is easy to see. Not only has it invested substantially in acquiring other companies, but the vast majority of these acquisitions took place in its core segment of products and services for business clients. The company’s massive activity in this segment, especially cloud services and productivity suites, seems to be an important strategic instrument in its attempt to refocus on certain products. Other acquisitions are meant to bolster its existing product lines. For instance, the cases involving content editors relate to its Xbox and gaming offerings. Similarly, the company used acquisitions to improve its platform offerings. The only case that could suggest a deviation from this general pattern is the acquisition of a virtual reality social network. Even though the exact purpose of this acquisition is beyond our knowledge, this single acquisition does not suggest that Microsoft would use acquisitions as a major instrument to enter new segments.

## 4.2 Discussion

From the preceding discussions, it appears that GAFAM use acquisitions to reinforce their business model. Our evidence shows that these firms are massively acquiring in their core segments or segments that are complementary to their core one. This does not suggest that competition between the five firms intensifies but rather that they use mergers to reinforce their most successful products where they already enjoy a strong market position.

Regarding the acquisitions in the non core segments, we observe three interesting features. First Amazon, Facebook, Google and Apple are substantially acquiring tools for editors. For Amazon with its “Prime” offer and Google with its paid version of its video service Youtube Premium, these acquisitions help develop this segment as such and compete for audience with other firms, e.g. Netflix. For Facebook, Apple and to some extent Google, acquisitions seem to be more of a way to attract traffic and enhance the attractiveness of their core products. Second, we observe Apple’s, Google’s and Amazon’s substantial acquisitions in the business segment. Apple’s acquisitions mainly concern data analytics companies but Apple has not yet developed a specific offer for business clients. On the other hand, Google and Amazon seek to develop their business segments and compete with the dominant firm, Microsoft, for consumers. Acquisitions are a means of reinforcing their product supply and to compete with Microsoft. Third, we observe that Google and to a lesser extent, Amazon have the most diversified acquisition profile and clearly want to extend their activities beyond their core business.

Finally, looking at the information regarding the age and funding raised by the targets (see Appendix B), we notice important differences in GAFAM strategies. With an average of 4.05 years for Facebook and 4.42 for Google, they both acquired substantially younger companies than Apple (average age of 6.52), Amazon (8.00) and Microsoft (7.00) did.<sup>17</sup> Facebook and Google mostly acquire young startups while Amazon and Microsoft buy more established firms and this strategy seems to be stable over time. This information is further borne out by the number of funding rounds and the amount of venture capital collected. Firms acquired by Facebook and Google have completed less funding rounds and collected less funds, in average, than those acquired by Amazon and Microsoft. All the indicators suggest that Facebook and Google buy companies at an earlier stage of development than the other firms, especially Amazon and Microsoft. Acquiring younger firms is more likely to be motivated by these firms’ assets rather than their product. We examine this hypothesis further in the following section.

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<sup>17</sup>In a recent report (Argentesi *et al.*, 2019) reviewing the acquisitions made by Facebook, Google and Amazon since 2008, the authors found similar patterns with Facebook acquiring younger firms (average age 3.7 years) than Google (4.4 years) and Amazon (6.5 years) did.

## 5 Evolution of the target firms and products

The objective of this section is to see what happens to the acquired products and by doing so, get more detailed information about what motivates acquisition. Following an acquisition, the targets product might continue to be offered under its original name and brand. In this case, the motives for the acquisition could have been the revenues and/or the users (or user growth) the product was able to attract and might continue to do so. Inversely, should the product and its brand disappear or be integrated into the firm’s ecosystem, various possible motivations are conceivable. The acquiring firm could have wanted to add some functionality of the acquired product for its own products. In this case, the product might continue to exist, but under a different brand, name and layout. Additionally, intellectual property or other technological know-how might have been the driver of the acquisition. Finally, the transaction could be qualified as a so-called *acqui-hire*, if the main objective was to add engineers, programmers or other high-quality employees to the company.<sup>18</sup>

The integration of firms post-acquisition can be revealing about the rationales underlying the transaction in the first place. Puranam and Srikanthfor (2007) argue that acquiring firms can be interested in target companies either for *“what they know or for what they do”*. If acquirers are mainly motivated by the knowledge stock (technology, IP or human resources) of a target i.e. what they know, they will fully integrate it into their own processes. On the other hand, if the acquirer wants to use the target as an additional source of innovation i.e. what they do, it will keep it running as a separate entity.

We cannot access information on the structural and organizational integration of target firms. However, we use similar reasoning to that of Puranam and Srikanthfor (2007) to verify the evolution of targets brands. If the product is discontinued under its original brand, the acquirer is likely to be more interested in the knowledge and the technology. If it is continued under its original brand, the main motivation is more likely to be the product in itself and its users. The evolution of the products reveals information about what motivates the acquisition.

To assess whether a target’s product brand was discontinued or kept running after a transaction, we checked the companies’ websites and press articles covering the acquisition. We consider a product to be discontinued if:

- Firms announce the product shutdown themselves.
- The website of the product or company is taken down.
- The website is still working but no longer offer products.
- The website is still working and offering products but announces that support for these products has stopped and/or that no updates will be provided.

Panel (a) of figure 9 displays the overall share of discontinued brands post-transaction. 105 brands of target firms were discontinued within a year after the acquisition. Representing 60% of all cases, these are the vast majority. In 47 cases, the targets’ products remained active and continued to be offered just as before the acquisition. In 23 cases, or 13%, there was not enough or clear information about the target’s product. This can be seen as indication that GAFAM firms are often not interested in the market performance of the firms and products, but rather in their knowledge.

Panel (b) of figure 9 represents the share of discontinued product brands for each firm. Apple shuts down most products. In 26 out of 33 cases, the target’s product disappeared in its initial form after the transaction. This reflects Apple’s choice of a closed system of products. Given that Apple mostly acquired in its core segments the many discontinued products suggests that it wants to improve its existing products, or develop new products in these segments

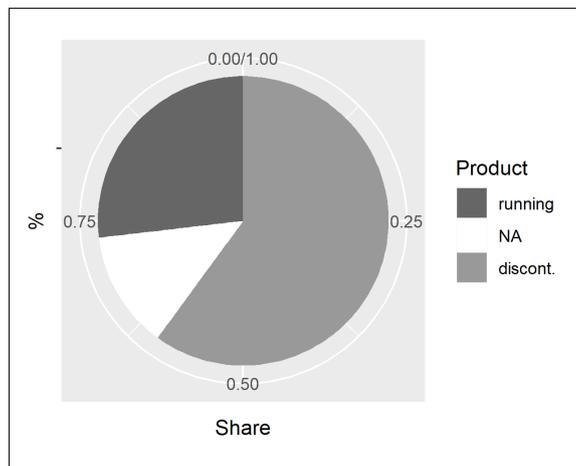
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<sup>18</sup>See Kim (2018) on the effectiveness of startup acquisitions as a hiring strategy.

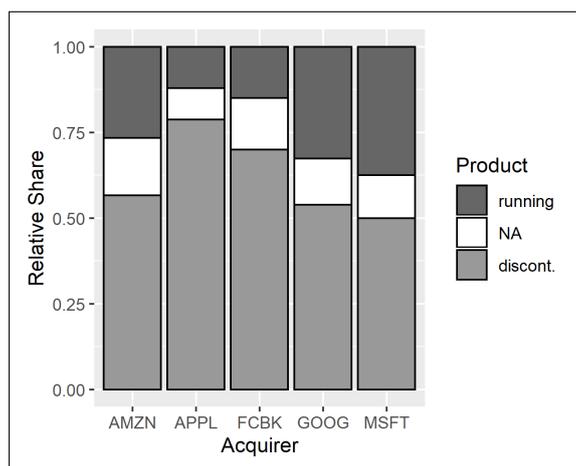
internally instead of adding "full-grown" products to its ecosystem. A similar pattern emerges for Facebook.

Figure 9: Running vs. discontinued products

Panel (a): all acquisitions



Panel (b): acquisitions by firms



Amazon, Google and Microsoft, however, keep between 27% and 37% of their targets' products up and running. For Amazon and Microsoft this could mean that they want to diversify their products within their segments. For Google it might as well be a consequence of its rather expansive M&A strategy. When entering new segments, an acquirer could have higher incentives to keep acquired products on the market.

To examine this question further, we run a Probit regression to explain the drivers of the product discontinuation's decision. In the estimations, we remove those firms for which the decision cannot be assessed. Results of the Probit estimations and the LPM estimations with robust standard errors are presented in Table 10. This reports the average marginal effects.

The estimations show that younger firms are less likely to be continued. Indeed, younger startups are more likely to be bought for their knowledge rather than their products, making shutdown more likely. The coefficient for an acquisition in the core segment is positive and significant. GAFAM are more likely to discontinue a product when it is part of their core segment. So, their acquisitions in the core segment are likely to be knowledge driven while acquisitions outside the core segment are more likely to be product driven. Conversely, they are less likely to discontinue a product acquired in the non core segment in which there are active.

Apple, Facebook and Amazon are more likely to shut down the products they acquired, with

Table 10: Probit (Average Marginal Effects) + LPM (robust standard errors)

	Probit	LPM	Probit	LPM	Probit	LPM
(Intercept)	0.01 (0.10)	0.54*** (0.11)	0.21** (0.08)	0.74*** (0.10)	0.12 (0.10)	0.65*** (0.12)
Age	-0.01* (0.00)	-0.01* (0.01)	-0.01* (0.00)	-0.01* (0.01)	-0.01* (0.00)	-0.01* (0.01)
GOOG	0.13 (0.10)	0.13 (0.11)	0.05 (0.10)	0.06 (0.11)	0.15 (0.10)	0.14 (0.11)
AMZN	0.18* (0.09)	0.21 (0.14)	0.15 (0.09)	0.16 (0.12)	0.21** (0.08)	0.24* (0.13)
FCBK	0.23** (0.08)	0.29* (0.14)	0.19* (0.09)	0.22* (0.12)	0.22** (0.08)	0.28* (0.14)
APPL	0.30*** (0.07)	0.35*** (0.10)	0.29*** (0.07)	0.34*** (0.10)	0.32*** (0.06)	0.38*** (0.10)
Core	0.21** (0.08)	0.21* (0.08)			0.20* (0.08)	0.20* (0.08)
Active			-0.19* (0.08)	-0.18* (0.07)		
2016					-0.19* (0.10)	-0.17* (0.08)
2017					-0.28** (0.10)	-0.24** (0.09)
AIC	178.79		178.92		174.61	
BIC	199.91		200.04		201.77	
Log Likelihood	-82.40		-82.46		-78.31	
Deviance	164.79		164.92		156.61	
Num. obs.	151		151		151	

\*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ ,  $p < 0.1$

a more significant effect for Apple and Facebook, as illustrated by the descriptive statistics. Finally, adding a dummy for the acquisition year, we observe that more recent acquisitions are more likely to be continued (so far).

## 6 Killer Acquisitions

Finally, we use our data to search for a possible killer acquisition, i.e. the acquisition of a *potential* competitor. Such an acquisition could impede future competition on the market and competition watchdogs are more and more concerned by the existence of such a merger.

In the digital economy, a firm that managed to attract a large user can extend its product bundle and turn to a sizeable competitor of an existing platform, even if products are *a priori* different. Identifying products segments by user groups, as we did, rather than by functionality is an interesting tool to identify potential competitors of the incumbent platform. A sizeable network within the core segment could be a competitive threat to the incumbent even if products are different. So, a first condition to identify a potential killer merger is to have an acquisition in the firm's core segment where the acquirer enjoys a strong market position.

Second, to be a potential competitor, the target should have a sufficiently large user base. Firms that develop software, applications or devices but that have not yet attracted users cannot

be considered potential competitors of the incumbent.

Last, the product of the target should be continued. As we argued above, when the firm is interested in the target’s assets, especially in its core segment, products are more likely to be discontinued. Conversely, if the firm is interested in the product and its users, the product should be continued under its initial brand name. When a firm has a large user base, changing its brand name may move consumers away, especially if there are network effects, switching costs and brand loyalty. For these reasons, a sizeable competitor is likely to continue to operate under its pre-acquisition name.<sup>19</sup>

In the following table, we identify all the acquisitions in the core segments that have been continued under their initial brand name. Few (12) acquisitions appear to fit these two criteria and most of them complement the acquirer’s existing products, i.e. these are mainly vertical mergers improving the acquirer’s products.

	Acquirer	Target	Segment	Product	Funding (\$m)
1	AMZN	Souq	Merchants	retail website	460
2	MSFT	LinkedIn	Businesses	prof soc network	154.8
3	MSFT	6Wunderkinder / Wunderlist	Businesses	productivity	34.9
4	MSFT	Event Zero	Businesses	software	13.7
5	MSFT	Sunrise	Businesses	productivity	8.2
6	GOOG	AIMatter	Consumers	picture editing	2
7	FCBK	Masquerade	Consumers	sharing app	1
8	MSFT	Cycle Computing	Businesses	cloud	1
9	AMZN	Whole Foods Market	Merchants	supermarket	
10	AMZN	WING	Merchants	delivery service	
11	MSFT	Mobile Data Labs	Businesses	productivity	
12	MSFT	Adxstudio	Businesses	crm	

Table 11: Mergers in the core segment, continued targets

Of these twelve acquisitions, there are only three cases where the target could represent a competitive threat to the buying firm because of its large user base: the Amazon/Souq<sup>20</sup>, Microsoft/LinkedIn and Facebook/Masquerade (MSQRD) deals.

Souq is the major online shopping website active in Arabia and in the Arabic world. In 2017, the company reported over 45 million visits monthly. This acquisition is a classical horizontal merger and Amazon used the acquisition to enter the Arabic world market where it was little present. So, the two firms were not really competing face-to-face in this part of the world. This acquisition enabled Amazon to consolidate its worldwide leading position. Here is a classical horizontal merger and a way for Amazon to enter a market that it did not cover yet. Notwithstanding the importance of the deal and the competitive concerns it may create, the merger, to our knowledge, has not been scrutinized by competition authorities.

LinkedIn is a professional social network reporting over 500 million users. The merger was cleared by the European Commission conditional to compliance with a series of commitments. In its analysis, the Commission acknowledged that Microsoft and LinkedIn are mainly active in complementary business areas as well as the little overlap existing between the two companies. The two main concerns were the CRM and the professional social network markets. On the CRM market, there was a risk of vertical foreclosure as access to the LinkedIn database has a large potential value and could give a huge advantage to Microsoft’s CRM solution. However, the Commission found that access to the full LinkedIn database was not essential to compete on

<sup>19</sup>Instagram, WhatsApp and Waze, which are referred to as potential examples of killer mergers, continue to operate under their original brand name after having been acquired by Facebook and Google respectively.

<sup>20</sup>On May 2019, the company name changed to Amazon.ae, so the service is now discontinued under its original brand name.

the market, and also that Microsoft was a relatively small player facing strong competitors in the CRM market. On the professional social network market, the Commission was concerned by the possible integration of LinkedIn into Microsoft’s product suite. This would give more visibility to LinkedIn and make entry harder on the professional social network market. Microsoft proposed remedies to meet these concerns.

The Souq and LinkedIn acquisitions reinforce Amazon’s and Microsoft’s market position by giving them access to new markets and complementary products respectively. But in neither case was the merger viewed as an attempt to kill potential competition. Things might be different with Facebook’s acquisition of Masquerade (MSQRD). MSQRD is a picture sharing app, similar to SnapChat, offering many filters for selfies. The company was very young (founded in 2015, acquired in 2016 by Facebook) and attracted limited funding (\$1 million). MSQRD experienced rapid user growth before the acquisition, with the number of app downloaded growing from 1.92 in January 2016 to 13.2 million in March 2016 (source: business insider). Following the acquisition, the product was continued under its original brand name. Clearly MSQRD was not yet a sizeable competitor for the existing social networks, and selfies are mainly shared with friends on social networks, generating traffic and revenues for the latter. Still, the case shares many of the Facebook Instagram deal (see Argentesi *et al.* 2019 for a critical review of the case) and competition authorities should further investigate this and other such merger cases.

## 7 Conclusion

When reviewing all GAFAM acquisition cases in our sample, two eye-catching patterns come out. First, most acquisitions are undertaken in core segments or other segments in which these firms are already active. Second, the majority of acquired products is discontinued post-acquisition.

This suggests, first, that many GAFAM acquisitions are driven by the desire to purchase valuable R&D inputs, such as the technology, IP rights and/or people of the target firms. Overall, more than 60% percent of the acquired products are shut following the transaction. This figure suggests that many mergers qualify as technology or talent (acqui-hire) acquisitions.

Second, the focus on already known and important segments raises the question whether these acquisitions are undertaken to increase market power or to realize synergies. The answer to this question is far from obvious and would need a case by case analysis. However, given the small size of target products, not just in revenues but also in terms of employees, classical synergies, like economies of scale and scope, seem rather implausible. Except for beneficial effects on innovation, the likely motives in these cases are the desire to improve market positions and to increase market power by adding new functionalities to their already successful products. The flip-side of this focus on core segments is that entry seems to be a rare motive to undertake acquisitions.

Hence, GAFAM’s main motivations in the digital economy appear to be the acquisition of innovation assets as well as the wish to increase market power.<sup>21</sup> Synergies and market entry, on the other hand, seem to be play less prominent roles.

These insights give a first impression of GAFAM’s M&A strategies. However, our classification suffers from limitations, which hinder a more precise analysis of these cases.

First of all, the user segments defined in this study do not necessarily represent markets in an antitrust meaning. In competition law, a market regroups all products competing against each other. In our analysis, we group products in segments according to the targeted user group. Therefore, products within the same segment in our analysis do not necessarily competing against each other. Conversely, products from different segments could conceivably exert

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<sup>21</sup>Pellegrino (2019) documents that the major exit route for your startups is no longer IPO but acquisition by an incumbent. According to his estimations, this huge acquisition wave substantially contributes to the increase of market concentration and the rising profit share of the input.

competitive pressures on one another. This broad classification restricts the implications that can be taken in terms of competition policy.

Second, we have no reliable information on the transaction values of these acquisitions. As a consequence, we treat all cases alike and limit ourselves to merger counts. Naturally, not all acquisitions are equally important. The acquisition of LinkedIn for \$26 billion is likely to have had a bigger impact on Microsoft's business than the acquisition of a small start-up. However, since we take account of all acquisition cases for a given period, even (the classification of) the mere number of acquisitions is revealing and improves our understanding of GAFAM strategies.

Despite the limitations described above, our findings suggest several implications in terms of competition policy.

GAFAM are widely considered to be economically dominant in their respective markets. This perception is partly confirmed by competition authorities that opened investigations against or even fined them for violations of antitrust laws. The fact that these firms are acquiring mostly in their core segments suggests that they are seeking to reinforce their market positions.

Except for ex-post investigations, the merger control regulation is the ex-ante tool in the antitrust arsenal to prevent or limit dominant positions from occurring. Yet, almost all GAFAM acquisitions fly under the radar of competition law. The low revenues of many targets prevent these cases from falling under the jurisdiction of antitrust authorities. Low revenue figures per se, though, do not imply, that these cases are benign or irrelevant. Hence, our findings reinforce the ongoing debate about the appropriateness of current notification systems based solely on turnover values and, more broadly, on the necessity to reform merger control analysis to better take into account the specificities of the digital economy.

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## Appendix A Data source

To structure the GAFAM firms' activities and products, we rely on their 10-K filings. These are annual reports that each listed company in the U.S. has to publish. They contain an overview of the firms' businesses and financial situation. We use the 10-K reports of 2014 in order to get a first-hand assessment of firms' situation before our sample period of 2015-2017. Thereby, we use their descriptions in part 1, item 1 of these reports, in which companies have to describe their activities, their subsidiaries as well as their products and markets.

To know about the acquisitions undertaken by the GAFAM firms and the acquired companies, we use the Crunchbase database. This is an online database tracking the tech sector and its companies. Its information comes from a huge network of partnerships with venture capital firms, executives, entrepreneurs and investors. Furthermore, it collects information through algorithmic web searching.

Through this database, we check acquisitions undertaken by the GAFAM firms as well as their subsidiaries for which the announcement date falls within the years 2015, 2016 and 2017. We drop 3 cases in which the firms bought specific assets from other companies or in which they just hired a single person from another company. From the database we collect information on targets age, origin, activities and products, the number of funding rounds they realized before the acquisition and the amount of money raised in these rounds.

We check and complement this information with press releases and public statements by the companies concerned, as well as press articles covering these acquisition cases. This enables us to verify the information from Crunchbase and to check the evolution of target firms and their products after they have been acquired. This results in a total sample of 175 cases for the 3 years under investigation. In order to evaluate the relative importance of their activities, we use information on revenue streams contained in part 2 items 6 and 8 of the 10-K files.

## Appendix B Acquisition Cases

Nr	Acquirer	Year	Target	Segment	Brand
1	AMZN	2015	2lemetry	Businesses	discont.
2	AMZN	2015	Amiato	Businesses	NA
3	AMZN	2015	Annapurna Labs	Businesses	NA
4	AMZN	2015	Clusterk	Businesses	discont.
5	AMZN	2015	Safaba Translation Solutions	Businesses	discont.
6	AMZN	2015	Shoefitr	Merchants	discont.
7	AMZN	2015	AppThwack	Editors	discont.
8	AMZN	2015	Elemental Technologies	Editors	discont.
9	AMZN	2015	Orbeus	NA	discont.
10	AMZN	2016	Biba	Businesses	discont.
11	AMZN	2016	NICE	Businesses	running
12	AMZN	2016	EMVANTAGE Payments	Merchants	discont.
13	AMZN	2016	Westland	Merchants	discont.
14	AMZN	2016	Cloud9 IDE	Editors	running
15	AMZN	2016	Curse	Editors	NA
16	AMZN	2016	Angel.ai	Consumers	discont.
17	AMZN	2016	Partpic	Consumers	discont.
18	AMZN	2017	Do	Businesses	discont.
19	AMZN	2017	harvest.ai	Businesses	discont.
20	AMZN	2017	Dispatch	Merchants	NA
21	AMZN	2017	Dispatch	Merchants	NA

Nr	Acquirer	Year	Target	Segment	Brand
22	AMZN	2017	Souq	Merchants	running
23	AMZN	2017	Whole Foods Market	Merchants	running
24	AMZN	2017	WING	Merchants	running
25	AMZN	2017	Body Labs	Editors	discont.
26	AMZN	2017	GameSparks	Editors	running
27	AMZN	2017	Thinkbox Software	Editors	running
28	AMZN	2017	ClipMine	Consumers	discont.
29	AMZN	2017	Graphiq	Consumers	discont.
30	AMZN	2017	Blink	Platform	running
31	APPL	2015	FoundationDB	Businesses	running
32	APPL	2015	Mapsense	Businesses	discont.
33	APPL	2015	Camel Audio	Editors	discont.
34	APPL	2015	faceshift	Editors	discont.
35	APPL	2015	Semetric	Editors	discont.
36	APPL	2015	Coherent Navigation	Consumers	discont.
37	APPL	2015	Perceptio	Consumers	NA
38	APPL	2015	Dryft	Platform	NA
39	APPL	2015	Linx Imaging	Platform	discont.
40	APPL	2015	Metaio	Platform	discont.
41	APPL	2015	Privaris	Platform	NA
42	APPL	2015	VocalIQ	Platform	discont.
43	APPL	2016	LearnSprout	Businesses	discont.
44	APPL	2016	tuplejump	Businesses	discont.
45	APPL	2016	Turi	Businesses	discont.
46	APPL	2016	Flyby Media	Consumers	discont.
47	APPL	2016	Gliimpse	Consumers	discont.
48	APPL	2016	indoor.io	Consumers	discont.
49	APPL	2016	Emotient	Platform	discont.
50	APPL	2016	LegbaCore	Platform	discont.
51	APPL	2017	init.ai	Businesses	discont.
52	APPL	2017	Lattice	Businesses	discont.
53	APPL	2017	Workflow	Businesses	running
54	APPL	2017	Pop Up Archive	Editors	discont.
55	APPL	2017	Regaind	Editors	discont.
56	APPL	2017	Shazam Entertainment	Editors	running
57	APPL	2017	Spektral	Editors	discont.
58	APPL	2017	Beddit	Consumers	running
59	APPL	2017	InVisage Technologies	Platform	discont.
60	APPL	2017	PowerbyProxi	Platform	discont.
61	APPL	2017	RealFace	Platform	discont.
62	APPL	2017	SensoMotoric Instruments (SMI)	Platform	discont.
63	APPL	2017	Vrvana	Platform	discont.
64	FCBK	2015	Teehan+Lax	Businesses	discont.
65	FCBK	2015	QuickFire Networks	Editors	discont.
66	FCBK	2015	Tugboat Yards	Editors	discont.
67	FCBK	2015	Wit.ai	Editors	running
68	FCBK	2015	TheFind, Inc.	Consumers	discont.
69	FCBK	2015	Endaga	Platform	discont.
70	FCBK	2015	Pebbles Interfaces	Platform	discont.
71	FCBK	2015	Surreal Vision Ltd	NA	discont.

Nr	Acquirer	Year	Target	Segment	Brand
72	FCBK	2016	CrowdTangle	Editors	running
73	FCBK	2016	FacioMetrics	Editors	discont.
74	FCBK	2016	Two Big Ears Ltd	Editors	NA
75	FCBK	2016	Eyegroove	Consumers	discont.
76	FCBK	2016	Masquerade	Consumers	running
77	FCBK	2016	InfiniLED	Platform	discont.
78	FCBK	2016	Nascent Objects Inc	Platform	discont.
79	FCBK	2016	The Eye Tribe	Platform	NA
80	FCBK	2017	Fayteq AG	Editors	discont.
81	FCBK	2017	Source3	Editors	discont.
82	FCBK	2017	Ozlo	Consumers	discont.
83	FCBK	2017	tbh	Consumers	NA
84	GOOG	2015	Bebop	Businesses	discont.
85	GOOG	2015	Granata Decision Systems	Businesses	NA
86	GOOG	2015	Timeful	Businesses	discont.
87	GOOG	2015	Softcard	Merchants	discont.
88	GOOG	2015	Toro	Advertisers	discont.
89	GOOG	2015	Apportable	Editors	discont.
90	GOOG	2015	Divshot	Editors	discont.
91	GOOG	2015	Launchpad Toys	Editors	discont.
92	GOOG	2015	Oyster	Editors	discont.
93	GOOG	2015	Pixate	Editors	running
94	GOOG	2015	Pulse.io	Editors	discont.
95	GOOG	2015	Thrive Audio	Editors	discont.
96	GOOG	2015	Digisfera	Consumers	discont.
97	GOOG	2015	Fly Labs	Consumers	discont.
98	GOOG	2015	Jibe Mobile	Consumers	NA
99	GOOG	2015	Odysee	Consumers	discont.
100	GOOG	2015	Agawi Inc	NA	discont.
101	GOOG	2015	Skillman & Hackett	NA	running
102	GOOG	2016	Dialogflow	Businesses	running
103	GOOG	2016	Hark	Businesses	NA
104	GOOG	2016	Orbitera, Inc.	Businesses	running
105	GOOG	2016	Pie	Businesses	discont.
106	GOOG	2016	Qwiklabs	Businesses	running
107	GOOG	2016	Subarctic Limited	Businesses	NA
108	GOOG	2016	Synergyse	Businesses	discont.
109	GOOG	2016	Anvato	Editors	running
110	GOOG	2016	Apigee	Editors	running
111	GOOG	2016	Bandpage	Editors	discont.
112	GOOG	2016	FameBit	Editors	running
113	GOOG	2016	LaunchKit	Editors	discont.
114	GOOG	2016	Moodstocks	Editors	discont.
115	GOOG	2016	Kifi	Consumers	discont.
116	GOOG	2016	LeapDroid	Consumers	discont.
117	GOOG	2016	Undecidable Labs	Consumers	NA
118	GOOG	2016	Urban Engines	Consumers	discont.
119	GOOG	2016	Cronologics Corporation	Platform	discont.
120	GOOG	2016	Eyefluence	Platform	discont.
121	GOOG	2016	Webpass	Platform	running

Nr	Acquirer	Year	Target	Segment	Brand
122	GOOG	2017	AppBridge	Businesses	running
123	GOOG	2017	Bitium	Businesses	running
124	GOOG	2017	Kaggle	Businesses	running
125	GOOG	2017	Limes Audio	Businesses	discont.
126	GOOG	2017	60dB	Editors	discont.
127	GOOG	2017	Crashlytics	Editors	running
128	GOOG	2017	Fastlane	Editors	running
129	GOOG	2017	Owlchemy Labs	Editors	running
130	GOOG	2017	AIMatter	Consumers	running
131	GOOG	2017	Relay Media	Consumers	running
132	GOOG	2017	Senosis Health	Consumers	NA
133	GOOG	2017	HTC - Pixel Phone Division	Platform	discont.
134	GOOG	2017	Redux ST	Platform	NA
135	GOOG	2017	Halli Labs	NA	discont.
136	MSFT	2015	6Wunderkinder / Wunderlist	Businesses	running
137	MSFT	2015	Adallom	Businesses	discont.
138	MSFT	2015	Adxstudio	Businesses	running
139	MSFT	2015	BlueStripe	Businesses	discont.
140	MSFT	2015	Datazen Software	Businesses	NA
141	MSFT	2015	FantasySalesTeam	Businesses	discont.
142	MSFT	2015	FieldOne Systems	Businesses	discont.
143	MSFT	2015	LiveLoop	Businesses	discont.
144	MSFT	2015	Metanautix	Businesses	discont.
145	MSFT	2015	Mobile Data Labs	Businesses	running
146	MSFT	2015	Revolution Analytics	Businesses	NA
147	MSFT	2015	Secure Islands Technologies	Businesses	discont.
148	MSFT	2015	Sunrise	Businesses	running
149	MSFT	2015	Talko	Businesses	discont.
150	MSFT	2015	VoloMetrix	Businesses	discont.
151	MSFT	2015	Havok	Editors	running
152	MSFT	2015	Double Labs	Platform	NA
153	MSFT	2015	N-Trig	Platform	discont.
154	MSFT	2016	Event Zero	Businesses	running
155	MSFT	2016	Genee	Businesses	discont.
156	MSFT	2016	LinkedIn	Businesses	running
157	MSFT	2016	PointDrive	Businesses	discont.
158	MSFT	2016	Solair	Businesses	discont.
159	MSFT	2016	Groove (dba Zikera)	Editors	running
160	MSFT	2016	MinecraftEdu	Editors	running
161	MSFT	2016	Mixer	Editors	running
162	MSFT	2016	Wand Labs	Editors	discont.
163	MSFT	2016	Xamarin	Editors	NA
164	MSFT	2016	SwiftKey	Platform	running
165	MSFT	2017	Cloudyn	Businesses	discont.
166	MSFT	2017	Cycle Computing	Businesses	running
167	MSFT	2017	Deis.com	Businesses	discont.
168	MSFT	2017	Heighten	Businesses	discont.
169	MSFT	2017	Hexadite	Businesses	discont.
170	MSFT	2017	Intentional Software	Businesses	discont.
171	MSFT	2017	Donya Labs	Editors	running

Nr	Acquirer	Year	Target	Segment	Brand
172	MSFT	2017	Open Build Service	Editors	running
173	MSFT	2017	AltspaceVR	Consumers	running
174	MSFT	2017	Swing Technologies	Consumers	discont.
175	MSFT	2017	Maluuba	NA	NA

## Appendix C Additional statistics

Table 13: Summary statistics Age, funding rounds and funding

(a) Age of Targets

Acquirer	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NAs
all	0	3.00	4.00	5.97	7.00	54	1
AMZN	1	3.00	4.00	8.00	7.75	54	0
APPL	1	3.00	4.00	6.52	10.00	26	0
FCBK	1	2.00	3.00	4.05	5.00	13	0
GOOG	0	3.00	3.00	4.42	5.00	20	0
MSFT	2	3.00	5.00	7.00	10.00	18	1

(b) Number of Funding Rounds

Acquirer	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NAs
All	1.00	1.00	2.00	2.55	3.00	14.00	52
AMZN	1.00	1.75	2.00	2.62	3.00	7.00	6
APPL	1.00	1.00	2.00	2.87	2.00	14.00	10
FCBK	1.00	1.00	1.00	1.80	2.50	4.00	5
GOOG	1.00	1.00	2.00	2.27	3.00	10.00	19
MSFT	1.00	1.00	3.00	2.96	4.00	9.00	12

(c) Total Amount of Funding (in thousands \$ )

Acquirer	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NAs
All	15.00	2,000.00	5,160.77	21,016.00	15,561.25	460,000.00	71
AMZN	50.00	1,880.00	4,296.50	33,713.37	13,778.75	460,000.00	10
APPL	350.00	1,695.70	4,700.00	20,911.21	21,781.80	143,500.00	15
FCBK	1000.00	3,215.00	3,775.00	7,714.15	11,830.39	26,000.00	10
GOOG	15.00	1,500.00	4,639.98	13,426.02	11,200.00	197,679.00	23
MSFT	520.00	3,450.00	10,500.00	24,759.21	21,045.61	154,800.00	13

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Voie du Roman Pays 34, L1.03.01

B-1348 Louvain-la-Neuve

Tel (32 10) 47 43 04

Email: [immaq-library@uclouvain.be](mailto:immaq-library@uclouvain.be)

[https://uclouvain.be/en/research-institutes/  
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# Mergers in the Digital Economy\*

Axel Gautier <sup>†</sup>& Joe Lamesch <sup>‡</sup>

June 2, 2020

## Abstract

Over the period 2015-2017, the five giant technologically leading firms, Google, Amazon, Facebook, Apple and Microsoft (GAFAM) acquired 175 companies, from small startups to billion dollar deals. In this paper, we provide detailed information and statistics on the merger activity of the GAFAM and on the characteristics of the firms they acquire. One of the most intriguing features of these acquisitions is that, in the majority of cases, the product of the target is discontinued under its original brand name post acquisition and this is especially true for the youngest firms. There are three reasons to discontinue a product post acquisition: the product is not as successful as expected, the acquisition was not motivated by the product itself but by the target's assets or R&D effort, or by the elimination of a potential competitive threat. While our data does not enable us to screen between these explanations, the present analysis shows that most of the startups are killed in their infancy. This important phenomenon calls for tighter intervention by competition authorities in merger cases involving big techs.

**Keywords:** Mergers, GAFAM, platform, digital markets, competition policy, killer acquisition  
**JEL Codes:** D43, K21, L40, L86, G34

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\*The authors would like to thank P. Bougette, M. Bourreau, N. Dürr, L. Madio, N. Petit, I. Salem, the editors Y. Spiegel and J. Waldfogel and the referee for their useful comments and suggestions and I. Peere for editing assistance. This research was funded through the ARC grant for Concerted Research Actions, financed by the French speaking Community of Belgium.

<sup>†</sup>HEC Liege Management School, University of Liege, LCII. Other affiliations: CORE and CESifo. Email: [agautier@uliege.be](mailto:agautier@uliege.be)

<sup>‡</sup>Luxembourg Competition Authority and HEC Liege Management School, University of Liege, LCII. Email: [joe.lamesch@uliege.be](mailto:joe.lamesch@uliege.be)

# 1 Introduction

The five largest tech giants, Apple, Alphabet (Google), Amazon, Facebook and Microsoft, known as GAFAM, are among the largest market capitalization firms worldwide. Operating as multi-sided platforms, they have created a large ecosystem of products, applications, services, content and users. They generate value by offering services to the various user groups gravitating around the platform and by enabling interaction between and within them.

The GAFAM have known tremendous internal and external growth over the last two decades. Their investment in research and development is huge with a cumulated investment of over \$ 71 billion for the year 2017. In addition to these important investments, they have an extremely intense mergers and acquisitions (M&A) activity. In 2017, for instance, they made 55 (different) acquisitions altogether, most of which were young and innovative startups.<sup>1</sup>

There are several reasons for one of the GAFAM platforms to acquire an innovative startup. First, the platform might be interested in the products developed by the startup. The GAFAM have developed a large ecosystem of products and services and are increasingly competing for attention, i.e. to retain consumers on their platform. In this context, adding new products or functionalities is part of the competitive process, acquisition therefore is one way of developing the firm's ecosystem. Second, the platform might be interested in the startup's inputs. They, indeed, have valuable assets (innovation, patent, engineer, talent<sup>2</sup>, customer base) that could be of interest to the platform. Last, acquisition may be a way of restricting competition and consolidating the platform's position on the market. As, in the digital economy, an important source of value comes from network effects, a firm with a substantial user base can eventually turn into a competitor of the incumbent network even if at the time of its acquisition there was no product overlap. . Hence, the preemptive acquisition of a small and promising startup can be used to restrict potential competition on the market. Nowadays, there are growing fears that the GAFAM acquire startups to protect their already strong market position.

Despite their intense merger activities and the vivid debates they generate, little is known about the the GAFAM's merger strategies. The present research ambitions to fill this gap. To this end, we have collected detailed information on the acquisitions of the GAFAM over the years 2015-2017 and on the GAFAM themselves. We have extracted all the necessary information from the firms' 10-k files<sup>3</sup> and the Crunchbase database<sup>4</sup>.

In this paper, we provide detailed information and statistics on the GAFAM's merger activity and on the characteristics of the firms they acquire. We focus in particular on the age, the funding and the origin of the target. We also identify the products they offer. To that end, we classify products in segments broadly defined according to the group of customers targeted. Six different user segments are identified: products offered to advertisers, businesses, consumers, merchants, content editors and platform products (mainly hardware and operating systems).

This product classification is used to identify the main segments of the platforms and their main income source. Given their multi-sided nature, some segments do not directly generate

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<sup>1</sup>This paper focuses on the five largest tech companies by market capitalization, Google, Amazon, Facebook, Apple and Microsoft. We have two reasons for focusing on these five firms. The first one is that they are the most active tech firms in terms of acquisition: over the years 2015-2017, they acquired a total of 175 firms (of the five, though, Facebook proved the least active with just 20 acquisitions.) The other tech firms appear to be less inclined to rely on such transactions. Over the same period, Twitter undertook 11 acquisitions, AirBnB 10, Uber 5 and Netflix only 1. The same holds for Asian tech companies: Alibaba acquired 12, Rakuten 6, Tencent 5 and Baidu 4. The second reason for focusing on the GAFAM is that acquisitions made by them received much more attention given their strong market position and growing fears that they would use mergers to strengthen their market power.

<sup>2</sup>The word *acqui-hire* is used to qualify an acquisition made with the purpose of recruiting the target's employees and talents. Kim (2018) and Ng and Stuart (2019) however show that this recruitment strategy is not necessarily effective.

<sup>3</sup><https://www.sec.gov/fast-answers/answersreada10khtm.html>

<sup>4</sup><https://www.crunchbase.com/>

revenues for the platform. This is particularly true for social media, Facebook and Google, for which users are extremely important. However, matching revenue with segments is important to identify the money side of the platform. For all the GAFAM, the revenue streams are extremely concentrated with most of the revenues coming from one or two segments: platform products (devices) for Apple, merchants for Amazon, advertising for Facebook and Google, business and platform products for Microsoft.

In a second step, we classify acquisitions and allocate each to one of the six business segments. Unsurprisingly, we observe that the firms acquire a lot in their main income segment. For instance, Microsoft used acquisitions to reinforce its business offers with 65% of the acquisitions in this segment. We also observe that there are two segments where the merger activity is quite intense: the digital content segment with 26% of all acquisitions and all firms being extremely active and, the business segment, where all firms, except Facebook and to a lesser extent Apple, make a lot of acquisitions. The intense merger activity in these two segments could be a sign of increasing rivalry for business customers and for digital content.

We further analyze the acquisition strategies of the GAFAM firms by looking at the evolution of the target post-acquisition. We observe that in the vast majority of cases, the acquirer discontinues the acquired brands. A product is considered to be discontinued if it is no longer supplied, maintained or upgraded under its original brand name. This practice is far from being systematic in the digital world and there are plenty of examples of products which continue to be supplied under their original name after an acquisition by one of the GAFAM.<sup>5</sup> In our sample, we observe that in more than 60% of the acquisitions, the acquired products were discontinued. Apple and Facebook seem to have a more systematic discontinuation policy than the other firms.

There are three main reasons to discontinue a product post-acquisition. First, the product may not be as successful as expected and the acquirer gives up the project. Second, the motivation for the acquisition was not the product or the brand in itself but the assets of the company or its innovation effort. Following the acquisition, the targeted assets are transferred to the acquirer and the target is shut down. Puranam and Srikanthfor (2007) explains that when acquisition is motivated by asset acquisition, the target is more likely to be integrated with the acquirer while when it is motivated by product acquisition, the target is more likely to be kept independent. Last, the product may be discontinued to protect the acquirer's market position. Such a merger followed by the disappearance of the acquired firm is now referred to as a killer merger. The firm acquires a target which develops a technology that can be used to compete with its own products in the future and the acquisition kills the competitive threat.<sup>6</sup> Killing rather than continuing a project competing with the acquirer's own product depends on the existence of demand and supply side complementarities. With strong complementarities, the acquirer is better off if it continues to develop the acquired project and supplies it along with its own product. Otherwise, the acquirer is better off killing the project and only develops its own version of the product.

We run Probit regressions to better understand the determinants of product discontinuation. In our estimation, the age of the target appears to be an important determinant of product discontinuation: younger firms are more likely to be discontinued. We also find that acquisitions in the platform's core segment, defined as the main income segment plus the user segment for the social medias, are more likely to be discontinued than acquisitions in the other segments. This suggests that products which are more closely related to the (broadly defined) main products of the platform are more likely to be discontinued. However, from our data, we cannot screen between the two explanations for product discontinuation: technology acquisition

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<sup>5</sup>YouTube, Android, Instagram, WhatsApp, Shazam, LikedIn to cite a few.

<sup>6</sup>Cunningham et al. (2018) collect data on acquisitions in the pharmaceutical industry. They document that 6% of acquisitions are killer acquisitions, where the acquiring firm buys a target developing a drug similar to its own and later stops the development of the target's product.

or the elimination of a potential rival. A more detailed analysis, product by product, should be carried on to understand the motivations for the merger. But our paper shows that most of the startups are killed in their infancy and this important phenomenon calls for a tighter intervention by competition authorities in merger cases involving big techs.

In the literature, there is, to our knowledge, no systematic analysis of the merger activity of the main digital platforms, Argentesi *et al.* (2019a, 2019b) being exceptions. Both papers make a critical assessment of several merger decisions taken by the Competition Market Authority (UK) in the digital economy, and suggests reforms to take better account of the specificities of digital markets. Furthermore Argentesi *et al.* (2019b) systematically review the mergers of Google, Amazon and Facebook (GAF) for the period 2008-2018. They classify mergers into eight segments, not according to the targeted user group as we did, but according to the products' purpose or functionality. They observe an intense acquisition activity in the AI, data science and analytics segments which raise concerns as data analytics technology combined with the huge amount of data collected by the GAF may constitute a barrier to entry for competitors. Finally, their analysis converge with ours in noticing that Google has a more intense and more diversified acquisition strategy than Amazon and Facebook who have a more focused acquisition pattern.

Few papers explicitly consider the striking features of the digital economy in a merger model. Motta and Peitz (2020) develop a model of acquisition by big tech firms. In their set-up, the startup (the target) is potentially financially constrained and may lack of the necessary resources to complete its innovative project. Acquisition by a less financially constrained big tech may remove this financial constraint and brings the new project to an end. Acquisition, however, has two drawbacks. First, the big tech may acquire the startup and stop the project (a killer acquisition). Second, acquisition could occur despite the fact that the startup has enough resource. In this case, the innovative project would be developed when the startup remains independent and acquisition only reduces competition on the market. Finally, on the basis of their modeling, Motta and Peitz develop theories of harm that integrate specific features of the digital economy like zero-price products or network effects.

Prat and Valletti (2019) develop a model of attention oligopoly in which platforms that may *a priori* look like different are competing for the attention of the targeted consumers, attention that will be sold to the advertisers and retailers. In this context, they consider a merger between two competing networks and show that the larger the overlap between the user bases, the larger the welfare losses resulting from the merger. Indeed, a merger between overlapping networks is more detrimental than a merger from dissociated networks. Hence, a merger between two networks offering different products to the same user groups can be used to substantially restrict competition on the market, even if the products offered to capture consumer attention are different.

Recently, the literature has considered the impact of a merger on innovation efforts.<sup>7</sup> Cabral (2018) develops a model where tech giants are competing with fringe firms. The focus of the model is on innovation and the impact of mergers on incentives to innovate. He distinguishes between radical and incremental innovations, showing that mergers decrease the former but favor the latter. The idea is that incremental innovation has more value if it is transferred to the dominant firm, as is the case of a merger. Anticipating a transfer, the startup partially internalizes the full benefit of its innovation and has more incentives to invest. On the contrary, startups have fewer incentives to invest in radical innovations that would allow them to replace the dominant firm. The reason is that increasing the benefit of incremental innovation also increases the opportunity cost of a radical innovation. Therefore, a merger may boost investment yet also reinforce the incumbent's dominance. Bryan and Hovenkamp (2020) reach a similar

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<sup>7</sup>A merger changes the incentives to innovate of both insiders and outsiders to the merger. Several recent papers focus on the impact of mergers on innovation incentives (see for instance Motta and Tarentino, 2017; Federico *et al.*, 2018; Bourreau and Jullien, 2018).

conclusion. They develop a model of startup acquisitions by dominant firms where startups innovate and develop components to be used by a tech giant. They show that technological leaders have more incentives to buy the startups to maintain their leadership and that this persistence of leadership through acquisition may not be welfare improving. Furthermore, startups may bias their research efforts towards the improvement of the technological leader, and in so doing reinforce its leadership.

Complementarities are important in the digital economy as many startups develop products or features that are complements to the platform’s ecosystem. Wen and Zhu (2019) show that the entry threat of the platform in a complementary market changes the incentives to innovate and the complementor’s pricing strategy. Rather than entry, a platform can buy the complementor to expand its ecosystem. Etro (2019) shows that such a merger between complements increases the innovation effort, as it solves the Cournot complement problem but restricts competition by making entry less likely.

The paper is organized as follows. In Section 2, we present the platform’s business model, the users group gravitating around it and the main revenue sources. In Section 3, we provide detailed information on the GAFAM firms’ merger activities over 2015-2017. In Section 4, we analyze the product continuation decision and we conclude in Section 5. In the appendices, we describe the data source in greater detail (Appendix A), provide a list of acquisitions (Appendix B) and additional statistics (Appendix C).

## 2 The GAFAM firms

The GAFAM firms are multi-sided platforms enabling interactions and value creation among multiple user groups. They constitute an ecosystem with multiple players gravitating around it. We identify five different user groups interacting on the platform, represented schematically in Figure 1.

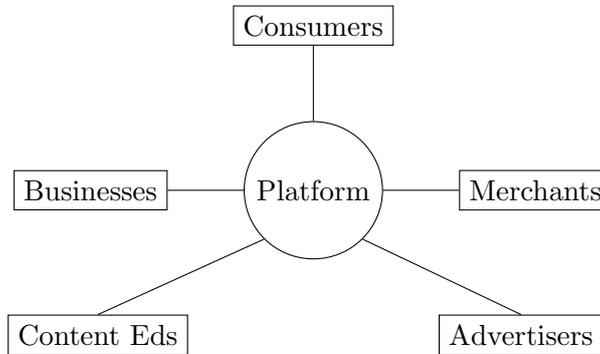


Figure 1: The platform and the user groups

- **Platforms:** Develop a technical infrastructure to enable interactions and to supply services. These products and services include hardware, operating systems and interfaces which are the platform’s technical backbones.
- **Consumers:** Use digital devices to navigate the internet and its content.
- **Businesses:** Use the products and services offered by the platform to increase their own productive or creative processes.
- **Merchants:** Use the platform as an online distribution system.
- **Content editors:** Create digital content and use the platform to make it accessible to users.

- **Advertisers:** Use the platform to place online advertising to reach potential clients.

## 2.1 A classification of activities by user groups

Platforms create value by offering products and services to each user category. Our objective is to have a schematic view of the platforms by identifying the groups they serve and the revenues generated by each user category. To do so, we proceed in three steps.

First, we identify the different products and services offered by the GAFAM and we categorize them according to the targeted customers. To do so, we use the detailed information contained in the 10-K reports.<sup>8</sup> These reports are written by the five firms themselves and give an exhaustive view of their activities and products at a given moment. We classify products on the basis of the descriptions and explanations provided in the 10-K reports, thus ensuring the consistent treatment of similar products. The classification of products by targeted user group is presented in Table 1.

Table 1: User Groups and Products

User Group	Product Examples
Advertisers	Advertising networks, auctions, serving technology, targeting services
Businesses	Cloud services, productivity software, collaboration tools, analytics software, CRM and sales software, data analytics
Merchants	Shopping websites, price comparison websites, delivery services, online payment services
Content Editors	Development tools for apps, music, videos, or games, online stores for content like app stores, music streaming
Consumers	Search engines, web browsers, social media, messengers, map services
Platform	Devices like smartphones, laptops, other wearables, operating systems and interfaces

Second, the firm's product portfolio enables us to identify the user categories served by each firm. The detailed analysis is provided in the next subsection and summarized in Table 2 reporting the segments in which the five firms were active in 2014. Whereas they were active in multiple segments, none in 2014 was serving all of them.

<sup>8</sup> Since we are interested in the acquisitions over 2015-2017, we use the 10-K reports of the year 2014 to classify the GAFAM's product portfolios and the associated income.

Table 2: Active Segments of the GAFAM, year 2014

Segment	AMZN	APPL	FCBK	GOOG	MSFT
Advertising			✓	✓	✓
Businesses	✓	✓			✓
Merchants	✓	✓			
Content	✓	✓	✓	✓	✓
Consumers		✓	✓	✓	✓
Platform	✓	✓		✓	✓

Last, we identify each firm’s main income sources. Ideally, we would have the income generated by each product, and relying on our classification, could reconstruct the income per user category. Unfortunately, firms provide detailed revenues, not per product but per product category. Categories are defined by the firms themselves and the classification varies among firms and over time. When it was not possible to match revenue streams with the six categories defined above, we grouped categories. Although this illustrative exercise yields a rough approximation, it, nevertheless, shows the extreme concentration of revenues, with one user group in each firm being, by far, the most important income source.

## 2.2 Revenue sources of the GAFAM

Tables 3 to 7 report each firm’s main sources of income for the year 2014. In each table, the right-hand column displays the revenue streams indicated by firms in their 10-K filings and their relative importance in terms of total revenues. These are matched with the products generating them in the middle column. The left-hand column indicates the user segment in which these products are assigned.

### 2.2.1 Amazon

Table 3 reports the revenue streams for Amazon in 2014. The company distinguishes two main sources of revenues: those coming from the sales of goods (merchants), media (editors) and the devices it produces (platform), and those coming from the sales of digital services, mainly cloud services for business. Online sales represent the largest revenue stream, accounting for more than 93% of the generated income. Although these three segments cannot be distinguished accurately, the merchant segment clearly accounts for the vast majority of these revenues. In 2014, the revenues from the Kindle (platform) were about \$ 4 billion (4.4%)<sup>9</sup> and those from Prime were around \$ 2.7 billion (3%).<sup>10</sup>

<sup>9</sup><https://www.forbes.com/sites/greatspeculations/2014/04/02/estimating-kindle-e-book-sales-for-amazon/#2903d19f23c6>

<sup>10</sup>10-K filings of 2016, p. 68

Table 3: Amazon Products and Revenues (2014)

Segment	Products	Revenues	
		Amount	Share
Merchants	Shopping websites: amazon.com, amazon.fr, etc.; ‘Marketplace’ platform (Online Resale); ‘Fulfillment’ (Delivery Services)	83,391	93.71%
Platform	‘Kindle’ e-readers, ‘Fire’ TVs, ‘Echo’ Speakers		
Content	‘Prime’ (among other things, access to TV shows and movies); ‘Kindle Store’ (Sale of digital books)		
Business	‘AWS’ Cloud offerings, ‘WorkDocs’ productivity suite, ‘WorkMail’ collaboration tools	5,597	6.29%

Source: Amazon’s 2014 10-K filings, p.27  
Amounts in million \$.

### 2.2.2 Apple

Table 4 shows Apple’s revenues. The company is active in five segments, the most important of which is the platform segment. The sale of these devices generates more than 90% of the income. To increase the value of its devices, Apple offers tools to users and content providers. These segments, which the company identifies as “iTunes, Software and Services”, generate the other revenue streams, mainly from its content stores.

Table 4: Apple Products and Revenues (2014)

Segment	Products	Revenues	
		Amount	Share
Platform	‘iPhone’ phones, ‘iPad’ tablets; ‘Mac’ laptops; other devices (watches, keyboards, etc.); ‘IOS’ operating systems	164,732	90.12%
Content	‘AppStore’ for mobile application; ‘iTunes’ for music; ‘iBooks’ for digital books	18,063	9.88%
Merchants	‘ApplePay’ mobile payment system		
Business	‘iWork’ productivity suite		
Customers	‘Safari’ web browser; ‘Facetime’, ‘Message’ communication tools; ‘Map’ navigation services		

Source: Apple’s 2014 10-K filings, p. 27.  
Amounts in million \$.

### 2.2.3 Facebook

Facebook is active in three segments: advertising, content and consumers. By offering tools and service to consumers and editors, the social network generates traffic that it monetizes through advertising. Table 5 shows that in 2014, Facebook’s revenues almost entirely came

from advertising. A minor part of revenues was generated through the sale of online content (online games) on its social network.

Table 5: Facebook Products and Revenues (2014)

Segment	Products	Revenues	
		Amount	Share
Consumer	'Facebook' social network and messenger; 'WhatsApp' messenger; 'Instagram' social network	0	0%
Advertising	'Audience Network' advertising network; 'Atlas', 'LiveRail'	11,492	92.19%
Content	Offers online content like games through its social network services	974	7.81%

Source: Facebook's 2014 10-K filings, p.43  
Amounts in million \$.

#### 2.2.4 Google

Google is active in 4 segments: editors, consumers, advertising, but also the platform segment. Table 6 indicates that the vast majority of its revenues was generated through the sale of advertising for consumers. Products for consumers, editors and the platform itself (mainly Android) aim at generating traffic for advertising. The other revenues were mainly generated by the sale of online content on YouTube and Play Store. Some minor revenues came from the sale of platform softwares and hardwares.

Table 6: Google Products and Revenues (2014)

Segment	Products	Revenues	
		Amount	Share
Consumer	'Google' search engine & vertical search engines; 'Google Maps' mapping and navigation services; 'Chrome' browser	0	0%
Advertising	'Ad Words' auctions, 'AdSense' advertising network	59,056	89.48%
Content	development tools; 'YouTube' video platform; 'PlayStore' for books, games, apps	6,945	10.52%
Platform	'Android' mobile operating system; 'Nexus' phones		

Source: Google's 2014 10-K filings, p.45  
Amounts in million \$.

#### 2.2.5 Microsoft

Microsoft is active in all segments except the merchant one. The revenue structure is less concentrated with two important segments: the business and the platform. Microsoft's revenue information in Table 7 shows that its business products, such as cloud services and productivity suites, were its main segment in 2014 generating 57% of the income. The platform software and devices generate 34.5% of the income. The remaining revenues were generated by the sale of development tools for content creators as well as advertising revenues on its Bing search engine.

Table 7: Microsoft Products and Revenues (2014)

Segment	Products	Revenues	
		Amount	Share
Business	'Azure', 'Office 365' Cloud services; 'Excel', 'Word', 'Powerpoint' productivity software'; other business solutions (ERM, CRM)	49,574	57.09%
Platform	'Windows' operating system; 'Surface' laptops; 'Lumia' phones; 'Xbox' gaming console	30,001	34.55%
Content	Development tools for content and game creators	7,258	8.63%
Consumer	'Bing' search engine		
Advertising	Advertising services		

Source: Microsoft's 2014 10-K filings, p.28.  
Amounts in million \$.

### 2.2.6 Revenues and profits of the GAFAM

The above analysis shows that revenues are extremely concentrated. For all firms except Microsoft, there is a single segment generating almost 90% of the revenue. Microsoft has two important sources of revenues: platform products and the business segment, the latter being the largest income source. Finally, none of these firms generate substantial income directly from the service offered to end-users. Consumers are offered services to generate traffic on the platform and the platforms sell them online content, goods and devices or expose them to advertising. Consumers are particularly important for social media platforms like Google and Facebook.

Differences can be observed in the amount of revenue each of these firms was able to create. Whereas Amazon, Google and Microsoft had somewhat similar revenue amounts, Apple and Facebook had respectively a much higher and a much lower revenue than the others. These differences might reflect the firms' distinct activities (i.e. manufacturing of hardware devices for Apple vs. pure software services for Facebook). Alternatively, they might result from the two companies' age difference.

Finally, it should be noted that revenue is not profit. Some segments may generate high income but low profits or the reverse. It is well documented in the financial press that the contribution to Amazon's profit of AWS is larger than its contribution to income. However, it is not possible to allocate profits to segments as none of the companies publish such information. The following table reports the profit of the GAFAM for the year 2014 in absolute value and relative to revenues. Interestingly, with the exception of Amazon which made losses in 2014 but has since turned to profits, all the firms have a comparable ratio of profit to income in the range of 20-25%. This huge profitability is another sign of the importance of the GAFAM in the digital economy.

Table 8: GAFAM revenues and profits for 2014

Firm	Revenue	Profit	Share of Revenue
Amazon	88,988	-241	-0.27%
Apple	182,795	39,510	20.59%
Facebook	12,466	2,940	23.52%
Google	66,001	13,928	21.10%
Microsoft	86,833	22,074	25.43%

Revenues and profits in million \$.

### 3 Acquisitions by the GAFAM

#### 3.1 Overall summary statistics

We identify 175 acquisitions made by the GAFAM on the Crunchbase database<sup>11</sup> for the years 2015, 2016, 2017, the list of which is given in Appendix B. We collect information about these acquisitions as well as the target firms. Table 9 represents some summary statistics about the cases.

Panel 9a shows the number of acquisitions in total, per firm and year. Microsoft and Google scored the highest by far with 52 and 40 acquisitions respectively, and Facebook the lowest with 20.<sup>12</sup>

Panel 9b indicates the origin of target companies. We regroup the countries of origin in three classes. Most were located in the United States, 47 were active in the European Union, and 26 in other parts of the world, i.e. Canada, Israel, India.

Panel 9c shows some statistics on the distribution of the target companies' age, their number of funding rounds and the amount of capital raised before being acquired. It appears that the GAFAM firms mostly bought fairly small and young technology companies. Half of the companies were created less than four years before being acquired.

We identify the number of funding rounds and the capital raised by the target.<sup>13</sup> Again, the statistics confirm that acquired companies were in their infancy with 2.5 completed funding rounds in average and a median funding of \$ 7 million.

In Appendix C, we provide additional statistics on the age and the funding of the target. We observe that Facebook and Google seemingly acquired even younger firms than the other three with a median acquisition age of three years. To illustrate, the median firm acquired by Facebook was aged three, completed one funding round and collected \$ 3.77 millions while the median firm acquired by Microsoft was aged five, completed three funding rounds and collected \$ 10.5 millions. Our statistics suggest that Google and Facebook targeted young startups as acquisitions while the other three focus on relatively more experienced companies.

#### 3.2 A classification of acquisitions by user groups

In addition to these statistics, we collect information on the products offered by the acquired company and classify them in different user categories. In 19 cases, we are unable to identify a segment for the acquired firm due to unavailable or unclear information.

<sup>11</sup>Crunchbase has a tool for searching acquisitions and these can be filtered by date and the acquirer's name.

<sup>12</sup>Facebook had a more intense merger activity in the period 2010-2016, as documented in Argentesi (2019b).

<sup>13</sup>We are unable to distinguish the companies that did not raise capital from those which did but for which the information was not available. Hence, the table only contains information on the firms that completed at least one funding round.

Table 9: Summary Statistics

(a) Number and Years of Acquisitions

	2015	2016	2017	Total:
GOOG	18	20	14	52
MSFT	18	11	11	40
APPL	12	8	13	33
AMZN	9	8	13	30
FCBK	8	8	4	20
Total:	65	55	55	175

(b) Origin of Target Firms

Region	US	EU	Rest of the World	Unknown
No. of Targets	110	30	26	9

(c) Age and funding

	Min.	Median	Mean	Max.	NA's
Age	0.00	4.00	6.09	39.00	1
No. Fund. Rounds	1.00	2.00	2.66	10.00	56
Amount (in million US\$)	0.015	7.00	23.79	460.00	72

Table 10 shows our classification of acquisitions by segments. Two important observations are in order.

First, the two most important segments are *business* and *editors* with, respectively 61 and 43 acquisitions. Amazon, Facebook, Google and Apple are substantially acquiring tools for editors. For Amazon with its Prime offer and Google with its paid version of its video service Youtube Premium, these acquisitions help develop this segment as such and compete for audience with other firms, e.g. Netflix. For Facebook, Apple and to some extent Google, acquisitions rather seem to be a means of attracting traffic and enhance the attractiveness of their products. In the business segment, Microsoft acquired the most but Apple, Google and Amazon were also very active. For Amazon and Microsoft, acquisitions are useful to reinforce their offer to business clients and strengthen their position on the market. Google acquired 14 firms in the *business* segment, mainly cloud services, productivity software and professional communication products, and may compete for some of the business consumers with the others. Apple mostly acquired data analytics companies and has not yet developed a specific offer for business clients.

Second, there is a strong focus on the main revenue segment; 65% of Microsoft's acquisitions are in the business segment, 36% of Apple's are in the platform segment and 26% of Amazon's are in the merchant segments. Google and Facebook acquired few companies in the advertising segment, but bought many companies in the editors and the consumers segments as it is important for them to acquire traffic on their platform.

Argentesi *et al.* (2019b) do a similar exercise for the acquisitions of Amazon, Facebook and Google for the years 2008-2018. They classify the three firms' acquisitions into nine different categories.<sup>14</sup> They found that all companies have substantially acquired data analytics startups. In addition, they show that Amazon and Facebook made numerous acquisitions in product categories similar to their most successful business lines: cloud computing and physical goods

<sup>14</sup>Communication apps and tools; Tools for developers; Physical goods and services; Digital content; Remote storage and file transfer; Advertising tools and platforms; Artificial intelligence, data science and analytics; Home, wellbeing and other personal needs and Others.

for Amazon and communication apps and tools for Facebook while Google has a more diversified acquisition profile. Though based on an alternative classification, our analysis confirms these observations.

Table 10: Acquisitions by user groups

Segment	Business	Editors	Consumers	Platform	Merchant	Advertisers	NA	Total:
AMZN	9	7	4	1	8	0	1	30
APPL	8	7	6	12	0	0	0	33
FCBK	1	8	5	5	0	0	1	20
GOOG	14	17	11	5	1	1	3	52
MSFT	26	8	2	3	0	0	1	40
Total:	58	47	28	26	9	1	6	175

## 4 Evolution of the target firms and products

The next step in our analysis is to look at what happens to the acquired firms and products. Following an acquisition, the targets product might continue to be offered under its original name and brand. Alternatively, the product can be discontinued and no longer supplied by the acquirer. As a matter of fact, this is the case for most products acquired by the GAFAM. In this section, we investigate this question in more detail.

To assess whether a target’s product brand was discontinued or kept running after a transaction, we checked the companies’ websites and press articles covering the acquisition. We consider a product to be discontinued if:

- Firms announce the product shutdown themselves.
- The website of the product or company is taken down.
- The website is still working but no longer offer products.
- The website is still working and offering products but announces that support for these products has stopped and/or that no updates will be provided.

On the basis of these criteria, we identify that 60% of the target firms were discontinued, most of them within a year after the acquisition. Only in 27% of the cases, the targets’ products remained active and continued to be offered just as before the acquisition. And for 13% of the cases, there was not enough or clear information about the target’s product. Table 11 contains detailed information on the evolution of the product post-acquisition.<sup>15</sup>

All firms discontinue a majority of the products they acquire. Apple does so even more, shutting down close to 80% of their acquisitions. This might reflect Apple’s choice of a closed system of products sold under a unique brand. To a lesser extent, it is also the case for Facebook, while Amazon, Google and Microsoft keep a substantially larger fraction of the acquired products active.

To examine this question further, we run Probit regressions to explain the drivers of the product discontinuation’s decision.<sup>16</sup> In the estimations, we remove those firms for which the decision cannot be assessed and we have a sample of 151 firms. We run six different models and the results of the Probit estimations are presented in Table 12. In the table, we report the average marginal effects, except for Model 6 where we have interaction variables.

<sup>15</sup>The information for each product is listed in Appendix B. The information was collected in September 2019.

<sup>16</sup>We also run LPM models with clustered standard errors and the results converge with the two methods.

Table 11: Running and discontinued products

	Running	Discontinued	NA
AMZN	17 (57%)	8 (27%)	5 (17%)
APPL	26 (79%)	4 (12%)	3 (9%)
FCBK	14 (70%)	3 (15%)	3 (15%)
GOOG	28 (54%)	17 (33%)	7 (13%)
MSFT	20 (50%)	15 (37.5%)	5 (12.5%)
Total:	105 (60%)	47 (27%)	23 (13%)

All models show that younger firms are less likely to be continued. The age coefficient is always negative and in most of the cases significant. In Model 1, we include only the identity of the acquirer. As the descriptive statistics show, Apple and Facebook have a higher probability to discontinue the products they acquire. In Model 2, we add the segment in which the target is active but it seems that there is no systematic segment effect in the estimations. In Model 3, we introduce two dummy variables: a variable *Main income* if the acquisition is in the main income segment of the acquirer<sup>17</sup> and a variable *Social* if the acquisition is in the user segment and acquired by a social media (Facebook and Google). Both variables have a positive sign, meaning that an acquisition in those segments makes discontinuation more likely but the estimated coefficients are not significant. In Model 4, we use a dummy variable *Core* which is the combination of *Main income* and *Social* and this variable capture the main segment of each firm, the money side for Amazon, Apple and Microsoft, the audience side for Facebook and Google. The variable *Core* is positive and significant. GAFAM are more likely to discontinue a product when it is part of their core segment. In Model 5, we use a dummy *Active* when the acquisition is in a segment where the acquirer is active but it is not its main core segment. The variable is negative and significant. This corroborates the previous evidences that discontinuation is more likely in the main segment of each firm. In Model 6, we interact the core segments with the firms. The model shows that Apple, Facebook and Amazon are more likely to discontinue their acquisitions, be it in their core segment or not, while Microsoft is more likely to discontinue its acquisitions but only in the business segment. Finally, in all models, the more recent acquisitions are more likely to be continued. This result should not come as a surprise as one of the reason for discontinuation is product failure, i.e. the idea is not as successful as expected. Uncertainty about product quality is likely to be resolved over time and it is therefore logic to observe that more ancient acquisitions are more likely to be terminated. Overall, our models show that the age of the target is a significant determinant of the product discontinuation decision and that discontinuation seems to be more likely in the core segments of the platform compared to the others. As usual, these results should be interpreted with care as the number of observation remains limited.

In the digital sector, there is a lot of uncertainty on the potential of young startups, the uncertainty being both technological and commercial. Success is hard to predict as, in many cases, it depends on network effects. To capture this uncertainty, we introduced dummies for the acquisition year and the results show that more recent acquisitions are less likely to be

<sup>17</sup>There is only one acquisition in the advertising segment, so that variable is only defined for Amazon, Apple and Microsoft.

Table 12: Probit estimations

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
(Intercept)	0.26*** (0.08)	0.28 (0.30)	0.27*** (0.08)	0.12 (0.10)	0.21*** (0.08)	-0.09 (0.53)
Age	-0.01* (0.00)	-0.01 (0.01)	-0.01* (0.01)	-0.01** (0.00)	-0.01** (0.00)	-0.03 (0.02)
GOOG	0.05 (0.10)	0.06 (0.12)	0.02 (0.10)	0.15 (0.10)	0.05 (0.10)	0.83 (0.48)
AMZN	0.15 (0.09)	0.15 (0.22)	0.11 (0.10)	0.21*** (0.08)	0.15 (0.09)	1.24** (0.54)
FCBK	0.17* (0.10)	0.16 (0.24)	0.13 (0.11)	0.22*** (0.08)	0.19** (0.09)	1.40** (0.64)
APPL	0.27*** (0.07)	0.24 (0.35)	0.24*** (0.08)	0.32*** (0.06)	0.29*** (0.07)	1.47** (0.54)
2016	-0.21** (0.10)	-0.25 (0.23)	-0.21** (0.10)	-0.19* (0.10)		-0.57* (0.32)
2017	-0.28*** (0.10)	-0.33 (0.26)	-0.29*** (0.10)	-0.28*** (0.10)		-0.91*** (0.31)
Merchants		0.01 (0.21)				4.97 (973.50)
Advertisers		0.26*** (0.04)				4.93 (973.50)
Editors		-0.14 (0.16)				-0.11 (0.35)
Consumers		0.11 (0.18)				0.92 (0.58)
Platform		0.16 (0.23)				0.67 (0.51)
Main Income			0.18 (0.11)			
Social			0.14 (0.11)			
Core				0.20** (0.08)		
Active					-0.19** (0.08)	
APPL*Platform						4.84 (275.86)
AMZN*Merchants						-4.78 (973.50)
MSFT*Business						1.12* (0.62)
GOOG*Consumers						0.12 (0.84)
FCBK*Consumers						-0.88 (1.00)
AIC	178.39	174.91	179.45	174.61	178.92	177.63
BIC	202.53	213.69	209.62	201.77	200.04	231.33
Log Likelihood	-81.20	-74.45	-79.73	-78.31	-82.46	-70.81
Deviance	162.39	148.91	159.45	156.61	164.92	141.63
Num. obs.	151	146	151	151	151	146

Model 1-5: Average marginal effect, Model 6: Estimated coefficients.

\*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$

discontinued. An acquisition made in 2016 has 20% fewer chances to be discontinued than an acquisition made in 2015; an acquisition made in 2017 has almost 30% fewer chances to be discontinued. Uncertainty, then, may explain some of the closure decisions but certainly not all.

When a product and its brand disappear or is integrated into the firm's ecosystem, various possible motivations are conceivable. The acquiring firm could have wanted to add some functionality of the acquired product for its own products. In this case, the product might continue to exist, but under a different brand, name and layout. The acquirer may also decide to sell the product under its own brand, which has an established reputation and a higher potential for growth. Additionally, intellectual property or other technological know-how might have been the driver of the acquisition.<sup>18</sup> Or, the transaction could be qualified as a so-called *acqui-hire*, if the main objective was to add engineers, programmers or other high-quality employees to the company. In all these cases, the acquisition strengthens the acquirer's position on the market and, it does not come as a surprise that discontinuation is more likely in the segments where the acquirer is already strong, i.e. acquisitions in the core segments are more likely to be discontinued as our model shows. According to this, technology acquisition is the main driver of the intense merger activity. As a matter of fact, this explanation is often advanced by the GAFAM to justify their numerous acquisitions.

Yet, there is another competing explanation. Acquisitions (or at least some of them) are motivated by the elimination of potential competitors. A young startup which develops a successful product and manages to acquire a sufficient large user base (or which has the potential to do so) can be a competitive threat for an incumbent platform. Acquisition at an early stage, then, is a means of preventing the development of future competition and to reinforce the acquirer's market power. In the digital sector, there is a growing fear that mergers are *killer mergers* aiming at eliminating potential competition. The data and the evidence we show are perfectly compatible with this explanation. The GAFAM are acquiring intensively, mostly in their core segments and our evidence shows that most of these products are no longer developed as independent products, and this is particularly true for young startups. Our paper adds to this debate by showing the importance of discontinuations in the digital sector. These facts can justify the fears that *killer mergers* are potentially important in the sector.

Unfortunately, our data does not enable us to screen between the two competing explanations for discontinuation, technology acquisition or *killer merger*. In the pharmaceutical sector, Cunningham et al. (2018) can track the development steps of the young startups (patent, clinical trials, etc.) acquired by the big pharmas and the proximity with the existing drug portfolio of the acquirer; they can therefore identify correctly *killer mergers*. As our data do not enable us to do so likewise, we cannot conclude that these discontinued acquisitions are *killer acquisitions*, nor that they aim at reducing competition on the market. Additional data on the product development and on the relative importance of the competitive threat exerted by the startup are needed, but they are not easy to find. However, our evidence shows that there is a concern and that some, if not all, of these mergers may be intended to restrict competition.

Finally, notice that the fact that a product is continued does not eliminate competition concerns. Instagram, WhatsApp and Waze, which are referred to as potential examples of *killer mergers*, continue to operate under their original brand name after having been acquired by Facebook and Google respectively. The decision to continue the development of the target's product or to kill it depends on complementarities between products. With strong complementarities, the acquirer prefers to continue the product rather than killing it.

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<sup>18</sup>Puranam and Srikanthfor (2007) argue that acquiring firms can be interested in target companies either for "*what they know or for what they do*". If acquirers are mainly motivated by the knowledge stock (technology, IP or human resources) of a target i.e. what they know, they will fully integrate it into their own processes. On the other hand, if the acquirer wants to use the target as an additional source of innovation i.e. what they do, it will keep it running as a separate entity.

## 5 Conclusion

In this paper, we show that most of the acquisitions do not survive and that the product supplied disappears in its original form after acquisition by one of the GAFAM. This should bring the attention of competition authorities. They indeed have the power to block an anticompetitive merger. Yet, despite their intense merger activities, only few GAFAM acquisitions were scrutinized by antitrust authorities. Currently, there are growing fears that anti-competitive mergers fly under the antitrust radar. This is particularly problematic for the acquisitions by the GAFAM who enjoy an already strong market position.

Two main reasons account for such fears. First, the target firm is often too small and its revenue usually falls below the usual threshold for investigation.<sup>19</sup> There are exceptions though. For instance, the mergers between Apple/Shazam (2018) Microsoft/LinkedIn (2016), Facebook/WhatsApp (2014) and Google/DoubleClick (2008) were all approved by the European Commission, and so were the mergers between Facebook/Instagram (2012) and Google/Waze (2013) by the OFT. Nevertheless, most GAFAM acquisitions are not scrutinized by competition authorities and none of them have been blocked.<sup>20</sup>

Second, the acquired start-ups develop products and services that do not overlap with the narrowly defined market in which the acquiring firm has a dominant position. For this reason, most acquisitions could be classified as conglomerate mergers and, as such, raise fewer competitive concerns. However, a successful start-up may rapidly turn into a competitor of the dominant platform. This is particularly true if the firm has managed to rapidly acquire a large user base. Indeed, even if there is no obvious overlapping between products, the firm can extend its products bundle and, with a sizable user group, turn into a significant competitor of the installed platform. In this case, the acquisition of the firm by the dominant firm may substantially reduce (potential) competition on the market. However, as there is a lot of uncertainty surrounding the startup's competitive potential, the anticompetitive effects of a proposed merger might be difficult to assess ex-ante as it is notably complicated to construct an appropriate counterfactual against which the effects of the merger should be appreciated. There is the risk of a false negative (clearing an anticompetitive merger). Several scholars consider that competition authorities have underestimated that risk in their assessments (see Argentesi *et al.*, 2019a) and that not only the risk but the cost of a type-II error should be considered (Bourreau and de Strel, 2019).

For these reasons, several recent high-profile reports from both sides of the Atlantic<sup>21</sup> propose reforms of the merger assessment procedure. The possible reforms include firstly, a revision of the notification thresholds to be taken into account, e.g. the transaction value, the number of affiliated users or other criteria. A change in the notification threshold is necessary to give competition authorities the opportunity to scrutinize the acquisition by a large platform of a small startup.<sup>22</sup> Secondly, they propose to change the balance of risk to give more importance to the potential competition exerted by the target on the acquiring platform, even if there is a lot of uncertainty surrounding future market evolutions. For the moment, a highly uncertain potential competition is balanced with the most likely efficiency effects. In the merger assessment, it is proposed to give more importance to the former and less importance to the latter. Last, a reversal of the burden of proof is suggested. In this case and in specific circumstances, it is up to the acquiring firm to demonstrate that the proposed acquisition has pro-competitive effects

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<sup>19</sup>Germany and Austria have recently modified their notification thresholds, including a reference to the value of the transaction.

<sup>20</sup>In August 2019, the FTC started to investigate Facebook's motivations for acquiring Instagram and WhatsApp.

<sup>21</sup>Argentesi *et al.* (2019a), Bourreau and de Strel (2019, 2020), Cremer *et al.* (2019), Scott-Morton *et al.* (2019)

<sup>22</sup>Wollmann (2019) shows that higher thresholds are detrimental to competition as they lead to a substantial increase in (unscrutinized) mergers, especially horizontal ones between competitors.

rather than to the competition authority to demonstrate that the mergers have a negative impact on the market.

With 60% of the products discontinued, the possibility of killing acquisitions cannot be leaved aside and it is important that competition authorities take into account the competitive potential of these young startups.<sup>23</sup> The analysis and the data we provide in this paper show that competition authorities should more closely scrutinize the merger activities of the technological giants.

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<sup>23</sup>Pellegrino (2020) documents that the increasing number of startup acquisitions leads to an increase in industry concentration and markups.

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## Appendix A Data source

To structure the GAFAM firms' activities and products, we rely on their 10-K filings. These are annual reports that each listed company in the U.S. has to publish. They contain an overview of the firms' businesses and financial situation. We use the 10-K reports of 2014 in order to get a first-hand assessment of firms' situation before our sample period of 2015-2017. Thereby, we use their descriptions in part 1, item 1 of these reports, in which companies have to describe their activities, their subsidiaries as well as their products and markets.

To know about the acquisitions undertaken by the GAFAM firms and the acquired companies, we use the Crunchbase database. This is an online database tracking the tech sector and its companies. Its information comes from a huge network of partnerships with venture capital firms, executives, entrepreneurs and investors. Furthermore, it collects information through algorithmic web searching.

Through this database, we check acquisitions undertaken by the GAFAM firms as well as their subsidiaries for which the announcement date falls within the years 2015, 2016 and 2017. We drop 3 cases in which the firms bought specific assets from other companies or in which they just hired a single person from another company. From the database we collect information on targets age, origin, activities and products, the number of funding rounds they realized before the acquisition and the amount of money raised in these rounds.

We check and complement this information with press releases and public statements by the companies concerned, as well as press articles covering these acquisition cases. This enables us to verify the information from Crunchbase and to check the evolution of target firms and their products after they have been acquired. This results in a total sample of 175 cases for the 3 years under investigation. In order to evaluate the relative importance of their activities, we use information on revenue streams contained in part 2 items 6 and 8 of the 10-K files.

## Appendix B Acquisition Cases

Nr	Acquirer	Year	Target	Segment	Brand
1	AMZN	2015	2lemetry	Businesses	discont.
2	AMZN	2015	Amiato	Businesses	NA
3	AMZN	2015	Annapurna Labs	Businesses	NA
4	AMZN	2015	Clusterk	Businesses	discont.
5	AMZN	2015	Safaba Translation Solutions	Businesses	discont.
6	AMZN	2015	Shoefitr	Merchants	discont.
7	AMZN	2015	AppThwack	Editors	discont.
8	AMZN	2015	Elemental Technologies	Editors	discont.
9	AMZN	2015	Orbeus	NA	discont.
10	AMZN	2016	Biba	Businesses	discont.
11	AMZN	2016	NICE	Businesses	running
12	AMZN	2016	EMVANTAGE Payments	Merchants	discont.
13	AMZN	2016	Westland	Merchants	discont.
14	AMZN	2016	Cloud9 IDE	Editors	running
15	AMZN	2016	Curse	Editors	NA
16	AMZN	2016	Angel.ai	Consumers	discont.
17	AMZN	2016	Partpic	Consumers	discont.
18	AMZN	2017	Do	Businesses	discont.
19	AMZN	2017	harvest.ai	Businesses	discont.
20	AMZN	2017	Dispatch	Merchants	NA
21	AMZN	2017	Dispatch	Merchants	NA

Nr	Acquirer	Year	Target	Segment	Brand
22	AMZN	2017	Souq	Merchants	running
23	AMZN	2017	Whole Foods Market	Merchants	running
24	AMZN	2017	WING	Merchants	running
25	AMZN	2017	Body Labs	Editors	discont.
26	AMZN	2017	GameSparks	Editors	running
27	AMZN	2017	Thinkbox Software	Editors	running
28	AMZN	2017	ClipMine	Consumers	discont.
29	AMZN	2017	Graphiq	Consumers	discont.
30	AMZN	2017	Blink	Platform	running
31	APPL	2015	FoundationDB	Businesses	running
32	APPL	2015	Mapsense	Businesses	discont.
33	APPL	2015	Camel Audio	Editors	discont.
34	APPL	2015	faceshift	Editors	discont.
35	APPL	2015	Semetric	Editors	discont.
36	APPL	2015	Coherent Navigation	Consumers	discont.
37	APPL	2015	Perceptio	Consumers	NA
38	APPL	2015	Dryft	Platform	NA
39	APPL	2015	Linx Imaging	Platform	discont.
40	APPL	2015	Metaio	Platform	discont.
41	APPL	2015	Privaris	Platform	NA
42	APPL	2015	VocalIQ	Platform	discont.
43	APPL	2016	LearnSprout	Businesses	discont.
44	APPL	2016	tuplejump	Businesses	discont.
45	APPL	2016	Turi	Businesses	discont.
46	APPL	2016	Flyby Media	Consumers	discont.
47	APPL	2016	Gliimpse	Consumers	discont.
48	APPL	2016	indoor.io	Consumers	discont.
49	APPL	2016	Emotient	Platform	discont.
50	APPL	2016	LegbaCore	Platform	discont.
51	APPL	2017	init.ai	Businesses	discont.
52	APPL	2017	Lattice	Businesses	discont.
53	APPL	2017	Workflow	Businesses	running
54	APPL	2017	Pop Up Archive	Editors	discont.
55	APPL	2017	Regaind	Editors	discont.
56	APPL	2017	Shazam Entertainment	Editors	running
57	APPL	2017	Spektral	Editors	discont.
58	APPL	2017	Beddit	Consumers	running
59	APPL	2017	InVisage Technologies	Platform	discont.
60	APPL	2017	PowerbyProxi	Platform	discont.
61	APPL	2017	RealFace	Platform	discont.
62	APPL	2017	SensoMotoric Instruments (SMI)	Platform	discont.
63	APPL	2017	Vrvana	Platform	discont.
64	FCBK	2015	Teehan+Lax	Businesses	discont.
65	FCBK	2015	QuickFire Networks	Editors	discont.
66	FCBK	2015	Tugboat Yards	Editors	discont.
67	FCBK	2015	Wit.ai	Editors	running
68	FCBK	2015	TheFind, Inc.	Consumers	discont.
69	FCBK	2015	Endaga	Platform	discont.
70	FCBK	2015	Pebbles Interfaces	Platform	discont.
71	FCBK	2015	Surreal Vision Ltd	NA	discont.

Nr	Acquirer	Year	Target	Segment	Brand
72	FCBK	2016	CrowdTangle	Editors	running
73	FCBK	2016	FacioMetrics	Editors	discont.
74	FCBK	2016	Two Big Ears Ltd	Editors	NA
75	FCBK	2016	Eyegroove	Consumers	discont.
76	FCBK	2016	Masquerade	Consumers	running
77	FCBK	2016	InfiniLED	Platform	discont.
78	FCBK	2016	Nascent Objects Inc	Platform	discont.
79	FCBK	2016	The Eye Tribe	Platform	NA
80	FCBK	2017	Fayteq AG	Editors	discont.
81	FCBK	2017	Source3	Editors	discont.
82	FCBK	2017	Ozlo	Consumers	discont.
83	FCBK	2017	tbh	Consumers	NA
84	GOOG	2015	Bebop	Businesses	discont.
85	GOOG	2015	Granata Decision Systems	Businesses	NA
86	GOOG	2015	Timeful	Businesses	discont.
87	GOOG	2015	Softcard	Merchants	discont.
88	GOOG	2015	Toro	Advertisers	discont.
89	GOOG	2015	Apportable	Editors	discont.
90	GOOG	2015	Divshot	Editors	discont.
91	GOOG	2015	Launchpad Toys	Editors	discont.
92	GOOG	2015	Oyster	Editors	discont.
93	GOOG	2015	Pixate	Editors	running
94	GOOG	2015	Pulse.io	Editors	discont.
95	GOOG	2015	Thrive Audio	Editors	discont.
96	GOOG	2015	Digisfera	Consumers	discont.
97	GOOG	2015	Fly Labs	Consumers	discont.
98	GOOG	2015	Jibe Mobile	Consumers	NA
99	GOOG	2015	Odysee	Consumers	discont.
100	GOOG	2015	Agawi Inc	NA	discont.
101	GOOG	2015	Skillman & Hackett	NA	running
102	GOOG	2016	Dialogflow	Businesses	running
103	GOOG	2016	Hark	Businesses	NA
104	GOOG	2016	Orbitera, Inc.	Businesses	running
105	GOOG	2016	Pie	Businesses	discont.
106	GOOG	2016	Qwiklabs	Businesses	running
107	GOOG	2016	Subarctic Limited	Businesses	NA
108	GOOG	2016	Synergyse	Businesses	discont.
109	GOOG	2016	Anvato	Editors	running
110	GOOG	2016	Apigee	Editors	running
111	GOOG	2016	Bandpage	Editors	discont.
112	GOOG	2016	FameBit	Editors	running
113	GOOG	2016	LaunchKit	Editors	discont.
114	GOOG	2016	Moodstocks	Editors	discont.
115	GOOG	2016	Kifi	Consumers	discont.
116	GOOG	2016	LeapDroid	Consumers	discont.
117	GOOG	2016	Undecidable Labs	Consumers	NA
118	GOOG	2016	Urban Engines	Consumers	discont.
119	GOOG	2016	Cronologics Corporation	Platform	discont.
120	GOOG	2016	Eyefluence	Platform	discont.
121	GOOG	2016	Webpass	Platform	running

Nr	Acquirer	Year	Target	Segment	Brand
122	GOOG	2017	AppBridge	Businesses	running
123	GOOG	2017	Bitium	Businesses	running
124	GOOG	2017	Kaggle	Businesses	running
125	GOOG	2017	Limes Audio	Businesses	discont.
126	GOOG	2017	60dB	Editors	discont.
127	GOOG	2017	Crashlytics	Editors	running
128	GOOG	2017	Fastlane	Editors	running
129	GOOG	2017	Owlchemy Labs	Editors	running
130	GOOG	2017	AIMatter	Consumers	running
131	GOOG	2017	Relay Media	Consumers	running
132	GOOG	2017	Senosis Health	Consumers	NA
133	GOOG	2017	HTC - Pixel Phone Division	Platform	discont.
134	GOOG	2017	Redux ST	Platform	NA
135	GOOG	2017	Halli Labs	NA	discont.
136	MSFT	2015	6Wunderkinder / Wunderlist	Businesses	running
137	MSFT	2015	Adallom	Businesses	discont.
138	MSFT	2015	Adxstudio	Businesses	running
139	MSFT	2015	BlueStripe	Businesses	discont.
140	MSFT	2015	Datazen Software	Businesses	NA
141	MSFT	2015	FantasySalesTeam	Businesses	discont.
142	MSFT	2015	FieldOne Systems	Businesses	discont.
143	MSFT	2015	LiveLoop	Businesses	discont.
144	MSFT	2015	Metanautix	Businesses	discont.
145	MSFT	2015	Mobile Data Labs	Businesses	running
146	MSFT	2015	Revolution Analytics	Businesses	NA
147	MSFT	2015	Secure Islands Technologies	Businesses	discont.
148	MSFT	2015	Sunrise	Businesses	running
149	MSFT	2015	Talko	Businesses	discont.
150	MSFT	2015	VoloMetrix	Businesses	discont.
151	MSFT	2015	Havok	Editors	running
152	MSFT	2015	Double Labs	Platform	NA
153	MSFT	2015	N-Trig	Platform	discont.
154	MSFT	2016	Event Zero	Businesses	running
155	MSFT	2016	Genee	Businesses	discont.
156	MSFT	2016	LinkedIn	Businesses	running
157	MSFT	2016	PointDrive	Businesses	discont.
158	MSFT	2016	Solair	Businesses	discont.
159	MSFT	2016	Groove (dba Zikera)	Editors	running
160	MSFT	2016	MinecraftEdu	Editors	running
161	MSFT	2016	Mixer	Editors	running
162	MSFT	2016	Wand Labs	Editors	discont.
163	MSFT	2016	Xamarin	Editors	NA
164	MSFT	2016	SwiftKey	Platform	running
165	MSFT	2017	Cloudyn	Businesses	discont.
166	MSFT	2017	Cycle Computing	Businesses	running
167	MSFT	2017	Deis.com	Businesses	discont.
168	MSFT	2017	Heighten	Businesses	discont.
169	MSFT	2017	Hexadite	Businesses	discont.
170	MSFT	2017	Intentional Software	Businesses	discont.
171	MSFT	2017	Donya Labs	Editors	running

Nr	Acquirer	Year	Target	Segment	Brand
172	MSFT	2017	Open Build Service	Editors	running
173	MSFT	2017	AltspaceVR	Consumers	running
174	MSFT	2017	Swing Technologies	Consumers	discont.
175	MSFT	2017	Maluuba	NA	NA

## Appendix C Additional statistics

Table 14: Summary statistics Age, funding rounds and funding

(a) Age of Targets

Acquirer	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NAs
all	0	3.00	4.00	5.97	7.00	54	1
AMZN	1	3.00	4.00	8.00	7.75	54	0
APPL	1	3.00	4.00	6.52	10.00	26	0
FCBK	1	2.00	3.00	4.05	5.00	13	0
GOOG	0	3.00	3.00	4.42	5.00	20	0
MSFT	2	3.00	5.00	7.00	10.00	18	1

(b) Number of Funding Rounds

Acquirer	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NAs
All	1.00	1.00	2.00	2.55	3.00	14.00	52
AMZN	1.00	1.75	2.00	2.62	3.00	7.00	6
APPL	1.00	1.00	2.00	2.87	2.00	14.00	10
FCBK	1.00	1.00	1.00	1.80	2.50	4.00	5
GOOG	1.00	1.00	2.00	2.27	3.00	10.00	19
MSFT	1.00	1.00	3.00	2.96	4.00	9.00	12

(c) Total Amount of Funding (in million \$ )

Acquirer	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NAs
All	0.015	2.00	5.16	21.01	15.56	460.00	71
AMZN	0.05	1.88	4.29	33.71	13.77	460.00	10
APPL	0.35	1.69	4.70	20.91	21.78	143.50	15
FCBK	1.00	3.21	3.77	7.71	11.83	26.00	10
GOOG	0.015	1.50	4.63	13.42	11.20	197.67	23
MSFT	0.52	3.45	10.50	24.75	21.04	154.80	13