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Mergers in the digital economy☆

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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.

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.[1]

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[1] 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.

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[2], 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 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[3] and the Crunchbase database.[4]

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 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.[5] 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 Srikanth (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.[6] 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.

[2] 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 (2020) however show that this recruitment strategy is not necessarily effective.

[3] https://www.sec.gov/fast-answers/answersreada10khtm.html

[4] https://www.crunchbase.com/

[5] YouTube, Android, Instagram, WhatsApp, Shazam, LikedIn to cite a few.

[6] 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.

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 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,b) 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 financially 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 ressource. 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.[7] 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 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 (2018) 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

[7] 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 Tarantino, 2017; Federico et al., 2018; Bourreau and Jullien, 2018).

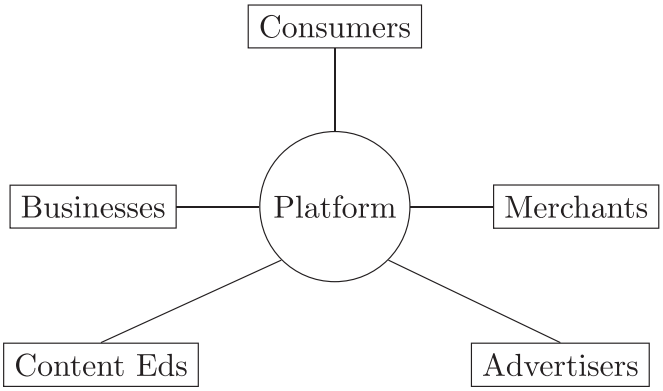

Fig. 1. The platform and the user groups.

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

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 Fig. 1.

- **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.

Table 2
Active segments of the GAFAM, year 2014.

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

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.[8] These reports are written by the five firms themselves and give a 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.

Second, the firm 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.

[8] 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 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 $.

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		

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

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 $.

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 $.

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 3–7 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

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 $.

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%)[9] and those from Prime were around $ 2.7 billion (3%).[10]

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.

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.

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.

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.

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 (Table 8). 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

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	2940	23.52%
Google	66,001	13,928	21.10%
Microsoft	86,833	22,074	25.43%

Revenues and profits in million $.

[9] https://www.forbes.com/sites/greatspeculations/2014/04/02/estimating-kindle-e-book-sales-for-amazon/#2903d19f23c6
[10] 10-K filings of 2016, p. 68

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

(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.

3. Acquisitions by the GAFAM

3.1. Overall summary statistics

We identify 175 acquisitions made by the GAFAM on the Crunchbase database[11] 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.[12]

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.[13] 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 firm 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.

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

[11] Crunchbase has a tool for searching acquisitions and these can be filtered by date and the acquirer's name.

[12] Facebook had a more intense merger activity in the period 2010–2016, as documented in Argentesi et al. (2019b).

[13] 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 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

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.[14] 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 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.

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 target 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.

Table 11
Running and discontinued products.

	Discontinued	Running	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%)

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.[15]

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 reflects 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

[14] 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.

[15] The information for each product is listed in Appendix B. The information was collected in September 2019.

Table 12
Probit estimations.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
(Intercept)	0.26***	0.28	0.27***	0.12	0.21***	-0.09
	(0.08)	(0.30)	(0.08)	(0.10)	(0.08)	(0.53)
Age	-0.01*	-0.01	-0.01*	-0.01**	-0.01**	-0.03
	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.02)
GOOG	0.05	0.06	0.02	0.15	0.05	0.83
	(0.10)	(0.12)	(0.10)	(0.10)	(0.10)	(0.48)
AMZN	0.15	0.15	0.11	0.21***	0.15	1.24**
	(0.09)	(0.22)	(0.10)	(0.08)	(0.09)	(0.54)
FCBK	0.17*	0.16	0.13	0.22***	0.19**	1.40**
	(0.10)	(0.24)	(0.11)	(0.08)	(0.09)	(0.64)
APPL	0.27***	0.24	0.24***	0.32***	0.29***	1.47**
	(0.07)	(0.35)	(0.08)	(0.06)	(0.07)	(0.54)
2016	-0.21**	-0.25	-0.21**	-0.19*		-0.57*
	(0.10)	(0.23)	(0.10)	(0.10)		(0.32)
2017	-0.28***	-0.33	-0.29***	-0.28***		-0.91***
	(0.10)	(0.26)	(0.10)	(0.10)		(0.31)
Merchants		0.01				4.97
		(0.21)				(973.50)
Advertisers		0.26***				4.93
		(0.04)				(973.50)
Editors		-0.14				-0.11
		(0.16)				(0.35)
Consumers		0.11				0.92
		(0.18)				(0.58)
Platform		0.16				0.67
		(0.23)				(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. *** $p < .01$, ** $p < .05$, * $p < .1$

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.[16] 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.

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

[16] We also run LPM models with clustered standard errors and the results converge with the two methods.

income segment of the acquirer[17] 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 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.[18] 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 strengthen 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 killing 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

[17] There is only one acquisition in the advertising segment, so that variable is only defined for Amazon, Apple and Microsoft.

[18] Puranam and Srikanth (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.

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.

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 anticompetitive 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.[19] 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.[20]

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 Streel, 2019).

For these reasons, several recent high-profile reports from both sides of the Atlantic[21] and academic papers (Cabral, 2020 and Motta and Peitz, 2020) 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.[22] 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.

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.[23] 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.

Author statement

The authors contributed equally to the work.

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

[19] Germany and Austria have recently modified their notification thresholds, including a reference to the value of the transaction.

[20] In August 2019, the FTC started to investigate Facebook's motivations for acquiring Instagram and WhatsApp.

[21] Argentesi et al. (2019a), Bourreau and de Streel (2019, 2020); Cremer et al. (2019); Scott Morton et al. (2019)

[22] 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.

[23] Pellegrino (2020) documents that the increasing number of startup acquisitions leads to an increase in industry concentration and markups.

from a huge network of partnerships with venture capital firms, executives, entrepreneurs and investors. Furthermore, it collects information though 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
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	VocallQ	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.

(*continued on next page*)

Nr	Acquirer	Year	Target	Segment	Brand
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.
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.

(*continued on next page*)

Nr	Acquirer	Year	Target	Segment	Brand
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
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
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 C1

Table C1
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

Supplementary material

Supplementary material associated with this article can be found, in the online version, at 10.1016/j.infoecopol.2020.100890

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