Cloud Infrastructure Services:

An analysis of potentially anti-competitive practices

Report by

Pr. Frédéric Jenny

for CISPE, October 2021

https://cispe.cloud/studies/fairsoftware

CONTENTS

ABOUT THE AUTHORS

This report has been prepared by Frédéric Jenny assisted by Antoine Chapsal and the Analysis Group team for CISPE.

Frédéric Jenny is Emeritus Professor of Economics at ESSEC Paris Business. He is also Co-Director of the European Center for Law and Economics of ESSEC since 2008. He was previously Non Executive Director of the Office of Fair Trading in the United Kingdom for for 7 years, Judge on the French Supreme Court from 2004 to August 2012, Vice Chair of the French Competition Authority from 9 years and President of the WTO Working Group on Trade and Competition from 1997 to 2004. He has a Ph.D. in Economics (University Paris II) and a Master's in Economics (Harvard University).

His research areas concern the relationship between structure and performance in European countries, particularly France, antitrust legislation in Europe. He was Global Professor of Antitrust in the New York University School of Law's Hauser Global Law School (2014), visiting professor at University College London Law School (2005-2012), Haifa University School of Law in Israel (2012), University of Capetown Business School in South Africa (1991), Keio University Department of economics in Japan (1984), Northwestern University Department of Economics in the United States (1978). He has published extensively on issues of trade, competition and economic development.

Antoine Chapsal is Managing Principal of Analysis Group (Paris). Antoine Chapsal is an economist who specializes in empirical and theoretical industrial organization. He has provided economic expertise in a large number of high-profile cases involving mergers, cartels, information exchanges, abuses of dominant positions, regulation, intellectual property matters, and damages quantifications. Antoine Chapsal has a Ph.D in economics, Universitat Pompeu Fabra, Barcelona; M.A., EU competitive law, King's College London; Paris diploma, Sciences Po; M.Sc., industrial organization, microeconomics, and econometrics, ENS Paris-Saclay, Cachan and Université Paris I – Panthéon Sorbonne; Aggrégation, social science, ENS Paris-Saclay, Cachan; B.A., economics, ENS Paris-Saclay, Cachan and Université Paris X, Nanterre.

Dr. Chapsal regularly publishes articles on competition economics, on subjects ranging from the econometric analysis of cartels to geographic market delineation and exclusionary strategies. He is an affiliated professor at the Sciences Po Department of Economics and a member of the CESifo academic research network.

EXECUTIVE SUMMARY

1. Cloud services adoption is a fundamental pillar of digital transformation for firms, institutions and private consumers. Since the beginning of 2017, the European cloud market has grown more than threefold, reaching EUR 5.9 billion (or $6.9 billion) in the third quarter of 2020[1]. However, market configuration in the provision of cloud computing services has also rapidly changed.[2,3]

2. In this study, we analyse, in particular, how providers of adjacent products to cloud infrastructure services, like software providers, also offering cloud infrastructure services could leverage their strong, sometimes dominant, position in adjacent products in order to distort competition for cloud infrastructure services. This may be detrimental for cloud services' users, who might face reduced choice and less flexibility in their cloud activities.

3. First, we describe the market for cloud services and its adjacent products and services to show the strong connection between the software and the infrastructure cloud services markets that could raise vertical competition concerns. Second, we examine the anti-competitive practices that could be adopted by dominant software providers in the cloud infrastructure services market segment to limit competition to the detriment of cloud users. Lastly, we provide a detailed review of business practices deployed by software providers also offering cloud services and we show the results of an in-depth survey of cloud services users to collect evidence of abusive practices by software providers.

4. Our study provides some preliminary but informative material to allow competition authorities to address the potential anti-competitive practices of software providers distorting competition in the cloud infrastructure services market segment, harming cloud infrastructure services' competitors and users. The anti-competitive practices identified by our study and our findings concur with the analysis of the European Commission in its impact assessment support study: some of strategies and unfair practices adopted by very large companies leveraging their dominant position in specific software markets are already affecting the cloud services market, thus threatening its contestability and distorting competition[4].

5. In several instances, however, these potentially unfair practices might fall short of traditional competition rules and could necessitate the recourse to new legal instruments. This is needed to avoid anti-competitive practices that could affect the ongoing transition to cloud services, harm the constitution of the Digital Single Market, and create a lasting impact for the decades to come. The "Digital Markets Act" currently under discussion by EU legislators could offer new ways to tackle these practices employed by very large software providers.

1 Synergy Research Group (2021), European Cloud Providers Struggle to Reverse Market Share Losses. Available at www.srgresearch.com/articles/european-cloud-providers-struggle-reverse-market-share-losses, (accessed on June 25th, 2021).

2 GlobeNewsWire (2013), Cloud Boom Continues as Quarterly IaaS/PaaS Revenues Exceed $2B. Available at https://www.globenewswire.com/fr/news-release/2013/05/30/907099/0/en/Cloud-Boom-Continues-as-Quarterly-IaaS-PaaS-Revenues-Exceed-2B.html, (accessed on June 28th, 2021).

3 Statista (2020), Vendor share of the public cloud infrastructure as a service (IaaS) market worldwide from 2015 to 2019. Available at www.statista.com/statistics/754837/worldwide-public-cloud-infrastructure-services-vendor-revenues/, (accessed on June 26th, 2021).

4 Publications office of the EU (2020). European Commission Digital Markets Act - Impact assessment support study - Annexes. Available at https://op.europa.eu/en/publication-detail/-/publication/2a69fd2a-3e8a-11eb-b27b-01aa75ed71a1/language-en, (accessed on June 26th, 2021).

OVERVIEW OF THE REPORT

In Section 1, we describe the market[5] for cloud computing services, its main adjacent markets and analyse the links between these markets.

- **Description of different cloud computing services.** The term "cloud computing" can describe multiple products and services, which can be identified along three different "service models" (i.e., infrastructure, platform, and software) and four "deployment models" (i.e., public, private, community, and hybrid)[6]. The combination of these two dimensions broadly encompasses the vast majority of cloud services. Nonetheless, due to recent developments, new components and ways of segmentation have emerged and these are also discussed. A separate segmentation approach concerns customer size and customer types, as cloud providers target (i) *digital natives*, i.e. ones who started their business with a cloud service, and (ii) *migration businesses*, who rely on an in-house server or offline services and plan to migrate to the cloud.
- **Adjacent products to cloud computing infrastructure.** Cloud computing infrastructure services provide storage and computation support to a variety of activities that are executed via software, and which are often perceived as complementary to cloud computing services by customers. As a result, markets for the supply of these software products can be considered to be adjacent to the supply of cloud computing infrastructure services. This section sets out the most relevant adjacent markets services (e.g., productivity and database software and services), identifies the primary competitors in these services, and analyses the potential market power of these competitors. Cloud service providers that are well-established in adjacent software product segment and also have a cloud infrastructure service offer could exploit their complementary products in order to distort competition in cloud computing infrastructure market segment.
- **The links between cloud computing infrastructure services and software.** In order for a company to leverage its market power on an adjacent product segment to distort the competition for one or more types of cloud infrastructure services, it is necessary to understand the link between the different products and establish the dependencies between them. For instance, if customers need both a specific type of software and cloud infrastructure services, and have a strong preference for a particular brand of software, under some conditions the company providing this software may have the ability and incentive to degrade the availability of this software on cloud infrastructure services provided by third parties. This may raise anti-competitive concerns. In this section, some examples based on different customer types are presented to understand the technical, commercial and operational links between these products.

In Section 2, we set out several anti-competitive practices from a theoretical perspective before examining how these could lead to negative impacts on competition and on the economy as a whole.

5 The Annex to this report includes a detailed analysis of the size (in terms of spending) and evolution of the cloud computing market, and describes the existence of any potential dominant companies in each market.

6 National Institute of Standards and Technology (2011), The NIST Definition of Cloud Computing. Available at https://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-145.pdf, (accessed on June 26th, 2021). We remark that some of the deployment models and in particular the hybrid mode may encompass traditional, on-premises components.

- **Bundling.** Firms might bundle distinct cloud-related services in such a way that the cost savings from those bundles might rule out other cloud infrastructure providers from being competitive. For example, Microsoft may be able to offer low (possibly anti-competitive) prices for bundles of software licences (e.g. Microsoft Office) together with Azure (Microsoft's own cloud infrastructure service), while keeping the prices of their software licences without Azure relatively high.

- **Tying, raising rival costs and self-preferencing**. Tying could take either a technical form (e.g., reducing or even eliminating interoperability) or a commercial form (e.g., licensing and pricing conditions that de facto tie services). These practices may have partial or full exclusionary effects for players that do not offer any closed-source[7] software. For instance, cloud infrastructure providers that are not present on adjacent software product segments may lose market share, or be forced to exit entirely. We may also remark that the presence of a cloud provider active on several adjacent cloud markets may also generate "conglomerate" effects whereby the impact of leveraging a dominant position is amplified and reinforced via multiple ties and links across these markets.

- **Predatory Pricing.** Firms may be able to cross-subsidise cloud computing infrastructure offerings by utilizing profits from other markets or segments. This may in turn allow them to charge below-cost prices for cloud computing infrastructure services, at a level which could not be met by other cloud infrastructure providers, thereby driving competition out of the market. This section discusses how such cross- subsidizing can be used to sustain predatory pricing, outlining the conditions typically required to demonstrate whether predation is taking place.

- **Potential increase in switching costs and "lock in" effects on customers.** Customers of cloud infrastructure providers may be subject to "lock in" effects, particularly in after-markets. To the extent that switching costs are high and across-service interoperability is low, customers who opt for certain cloud infrastructure providers may subsequently continue to acquire services from that same provider as the cost of changing cloud computing infrastructure provider in order to access alternative aftermarket products and services may be prohibitive. This may particularly affect new users of cloud infrastructure services that have imperfect information about different offerings, or limited foresight, and may end up being locked-in with their original provider as a result.

- **Effects on innovation.** The reduction in competition in cloud services may have impacts on the broader economy. A reduction in the degree of competition in the supply of cloud infrastructure services is likely to lead to a loss in the degree of investment and innovation in these services in the longer term, to the detriment of customers. In addition, given the pivotal role of cloud infrastructure services in the modern economy, a loss of competition and

7 Closed-source software is any software that remains legally the property (typically) of its publisher. This implies that there are restrictions around its use and its source code. Closed-source software is also referred to as "proprietary" and is the opposite of "open source".

innovation in this market may in turn trigger inefficiencies in the markets that rely on cloud infrastructure services as an input. This could generate potentially significant adverse long-term effects on the broader economy.

In Section 3, we evaluate the practices of major firms across a range of adjacent market segments to the cloud infrastructure service market segment. We then elaborate on the evidence gathered on the strategies deployed by those integrated firms, linking such practices to the potential for exclusionary behaviours and anti-competitive effects set out in the previous section. This evidence was obtained via two channels: first, we summarise examples of practices from publicly available sources; second, we further expand on it by detailing the results of an in-depth survey of cloud users.

- **Licensing restrictions and pricing strategies.** Some integrated firms started imposing penalties on customers that use their closed-source (proprietary) products (e.g. Windows) on rival cloud infrastructure providers. Evidence has been found of increases in licensing fees for customers requiring the use of proprietary software on cloud infrastructure that is different from that of the integrated provider owning it, with the price of the bundled software remaining, on the other hand, widely unaffected. These restrictions take the form of reduction or suppression of "Bring Your Own Licence" standards, or the application of large price differentials.
- **Other strategies.** We describe in this section other strategies potentially aimed at the foreclosure of rival cloud infrastructure providers that appear to have been deployed by legacy software providers to increase their penetration in cloud infrastructure services.

Finally, in Section 4 we conclude.

1

A description of cloud computing services and adjacent products and services

1. A DESCRIPTION OF CLOUD COMPUTING SERVICES AND ADJACENT PRODUCTS AND SERVICES

1. While the term "cloud computing" is commonly used to describe a multitude of products and services, a key common feature of the cloud is that it allows the scalable deployment of shared resources. In this section, we define the market and its key services, describe the demand for these services (mainly, who buys these services and how) and the supply (mainly, who provides these services and the infrastructure required).

2. In particular, we:

   - Describe the segmentation of cloud computing products and customer types (Section 1.1);
   - Based on the evidence available and recent decisions by the European Commission, set out which of the segmentations of the cloud computing market are likely to be considered "relevant markets" for the purposes of the assessment of potential anti-competitive behaviours (Section 1.2);
   - Briefly describe other software products that may be adjacent to cloud computing and set out key competitors and market shares in these product segments (Section 1.3).

3. Lastly, the Annex to this report includes a detailed background section describing the size of the relevant markets and associated segments, and sets out the evolution of market shares as well as the existence of any potential dominant companies.

1.1 OVERVIEW OF CLOUD COMPUTING SERVICES

4. In traditional or "on premise" IT, activities typically take place on a private infrastructure with a pre-defined capacity, on-site servers, and an ad-hoc system administration service. In contrast, users of cloud computing services can build, create and store data through a shared infrastructure, usually supplied by a third-party provider on a usage basis. In this section, we set out the major cloud service product offerings, as well as their deployment models and briefly set out different types of customers who acquire cloud services.

1.1.1 What is cloud computing?

5. The European Commission defines it as "a digital service that enables access to a scalable and elastic pool of shareable computing resources"[8]. Similarly, according to the official definition of the National Institute of Standards and Technology (NIST), cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a public pool of configurable computing tools (e.g. networks,

8 European Parliament (2016), *Directive (EU) 2016/1148 of the European Parliament and of the Council of 6 July 2016 concerning measures for a high common level of security of network and information systems across the Union.* Available at https://eur-lex.europa.eu/legal-content/GA/TXT/ ?uri=CELEX:32016L1148, (accessed on June 28th, 2021).

servers, storage and services) that can be rapidly provided and released with minimal management effort or service provider interaction[9].

6. The NIST definition outlines five characteristics of a service that must be present to be considered a cloud computing service:[10]

   - An on-demand self-service in which the client can be provided computing capabilities as needed, without requiring human interaction with its service provider;
   - Service capabilities are available over the network and accessible through standard mechanisms that enable use by heterogeneous customer devices such as mobile phones, laptops or tablets;
   - The provider's computing resources are pooled to serve multiple clients using physical and virtual resources, dynamically assigned according to their needs;
   - Service capabilities adjusted to one's needs (i.e., they can grow or shrink automatically when needed) and released to scale (i.e., adapt to the growth in size of the workload with no impact on performance) rapidly according to clients' needs; and
   - Finally, a cloud computing service is a measured service, meaning that providers can automatically control and optimise resources (e.g. storage, processing, active user accounts) used by clients.

7. In general, cloud computing solutions can be segmented along three different "service models" (i.e., infrastructure, platform, and software) and four "deployment models" (i.e., public, private, community, and hybrid). The combination of these two dimensions broadly encompasses the entirety of cloud services. However, there are alternative ways to segment the industry, which we discuss further at the end of this Section.

8. There are three models of cloud service:[11]

   - **Infrastructure-as-a-Service ("IaaS")** providers offer basic infrastructure services to customers. These services may include physical machines, virtual machines, networking, storage, or some combination of these. Clients utilise these services to avoid the capital expenditure and complexity of purchasing and managing their own physical servers and other data centre infrastructure. Each resource can come as a separate service component, usually in a pay-as-you-go arrangement, or in bundles (e.g. computing and storage). With an IaaS service, the final customer is responsible for licensing all required software, as if he were buying a bare metal machine, without any software component. For example, a cloud computing service provider such as Amazon's AWS manages the computing

9 National Institute of Standards and Technology (2011), *The NIST Definition of Cloud Computing.* Available at https://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-145.pdf, (accessed on June 26th, 2021).

10 Rountree, Derrick et. Castrillo, Ileana (2013), *The Basics of Cloud Computing: Understanding the Fundamentals of Cloud Computing in Theory and Practice.* Available at http://digilib.stmik-banjarbaru.ac.id/data.bc/4.%20Cloud%20Computing/2014%20The%20Basics%20of%20Cloud%20Comp uting%20Understanding%20the%20Fundamentals%20of%20Cloud%20Computing%20in%20Theory%20and%20Practice.pdf, (accessed on June 28th, 2021).

11 See, for instance, BMC blogsite: https://www.bmc.com/blogs/saas-vs-paas-vs-iaas-whats-the-difference-and-how-to-choose/,(accessed on June 26th, 2021).

infrastructure, while clients purchase, install, configure, and maintain their own software, operating systems, middleware, and applications. Clients of IaaS providers typically use these services for application testing and development, data storage and backup, web apps, and website hosting[12]. As of 2019, IaaS generated 7.1 Billion Euros in Europe[13].

- **Platform-as-a-Service ("PaaS")** providers offer, in addition to the underlying computing infrastructure, an operating system, development platform, and/or a database platform. Like IaaS, PaaS offerings comprise servers, storage, and networking services, but also middleware, development tools, business intelligence (BI) services, database management systems, and other utilities. With a PaaS service, the PaaS provider is responsible for licensing the operating system and for complying with applicable licence terms and conditions. The user purchases the resources from a cloud service provider on a pay-as-you-go basis and accesses them over a secure Internet connection. PaaS implementations allow customers to develop applications without having to worry about building the infrastructure needed or licensing the required software to support a development environment. As of 2019, PaaS services generated approximately and 2.8 Billion Euros in Europe.[14]

- **Software-as-a-Service ("SaaS")** provides a complete software solution that can be purchased on a pay-as-you-go basis. The client rents the use of an application for its organisation, and connects to it over the Internet, usually via a web browser. All the underlying infrastructure, middleware, application software and application data are located in the service provider's data centres. The cloud service provider administers the hardware and software and could also ensure the availability and the security of the application and the client's data. SaaS offerings are typically user-friendly solutions, where the final user (i.e., the end consumer of a service such as Dropbox) simply needs to access the application via, for example, a web-browser or an app. As of 2019, SaaS services generated approximately 18.1 Billion Euros in Europe.[15]

9. It is important to note, however, that customers can often tailor services according to their needs, for instance by mixing services from different models and providers. For example, a software developer could choose one cloud provider to run all of its day-to-day business operations (e.g., accounting, HR, office productivity software) while choosing another cloud provider to host customer facing applications (e.g., software interfaces, web applications, etc.).[16] This mode of usage is commonly referred to as "multi-cloud".

10. Figure 1 below summarises the components of the three cloud service models presented above. All services of an IaaS provider are nested within the services of a PaaS provider, which are in turn nested within the SaaS offering. As discussed in the following sections, while in theory customers could source their cloud

12 See, for example, Microsoft Azure website: https://azure.microsoft.com/en-gb/overview/what-is-iaas/, (accessed on June 26th, 2021).

13 IT Candor (2020), *Cloud services market spending by segment worldwide from 2015 to 2020 (in billion U.S. dollars)*. Available via *Statista* at: https://www.statista.com/statistics/540499/worldwide-cloud-computing-revenue-by-segment/.(accessed on June 26th, 2021).

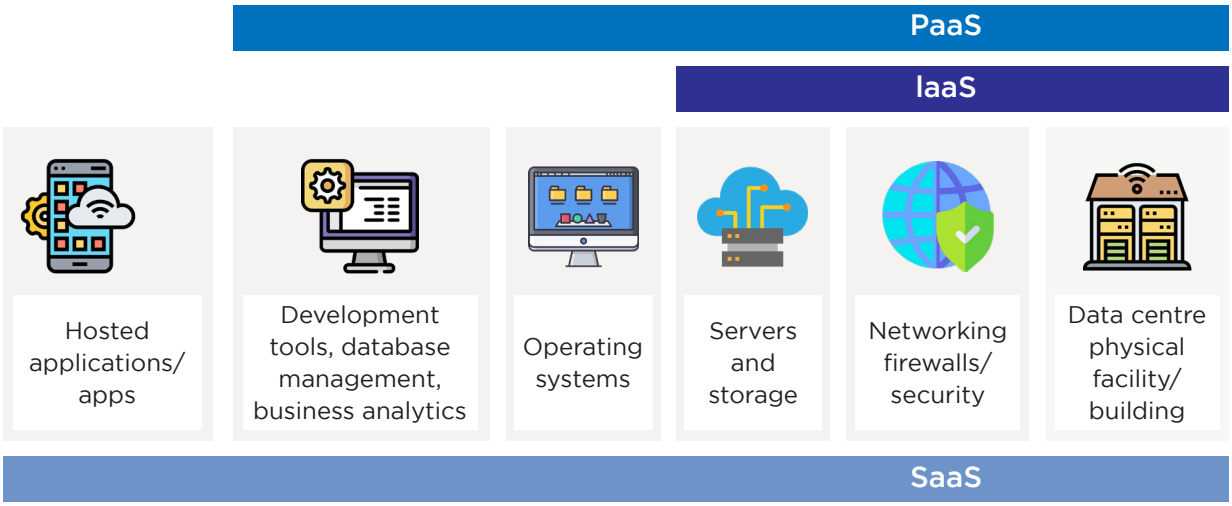
14 *Ibidem.*

15 *Ibidem.*

16 See, for instance: https://microservices.io/patterns/microservices.html, (accessed on June 26th, 2021).

infrastructure from one provider, their platform services from another, and their software/applications from yet other providers, in practice the SaaS model is the most commonly used, with SaaS and PaaS making up two thirds of the market, SaaS alone accounting for 50-60%.[17]

Figure 1: Components of cloud service models



Source: Microsoft[18]

Table 1: Examples of cloud computing solutions by service model and vendor

Cloud computing solution			
Vendor	**IaaS**	**PaaS**	**SaaS**
Amazon	AWS Elastic Compute Cloud	AWS Elastic Beanstalk, AWS Lambda	-
Microsoft	Microsoft Azure	Microsoft Azure	Microsoft Office 365, OneDrive
Google	Google Compute Engine (GCE)	Google App Engine	Google G Suite, Google Drive
Oracle	Oracle Cloud Infrastructure	Oracle Cloud Platform	Oracle Database Cloud Service
Apple	-	-	iCloud
Others	Alibaba Cloud, IBM Cloud, Rackspace Open Cloud	SAP Cloud, Apache Stratos Heroku Platform	Salesforce, Dropbox, Cisco WebEx

11. In addition to the three core service models described above, more recently new service models have also emerged. **Backend-as-a-Service ("BaaS")** is a cloud service model that allows mobile and web developers to outsource all the behind-the-scenes aspects of an application so that they can focus on the front-end only. Similarly, **Function-as-a-Service** ("FaaS"), also referred to as "serverless computing", enables customers to execute code without having to allocate processing resources in advance, allowing them to focus only on deploying application code. Due to their

17 Publications office of the EU (2020). *European Commission Digital Markets Act - Impact assessment support study - Annexes.* Available at https://op.europa.eu/en/publication-detail/-/publication/2a69fd2a-3e8a-11eb-b27b-01aa75ed71a1/language-en, (accessed on June 26th, 2021).

18 See for example, Microsoft Azure webpage: https://azure.microsoft.com/en-gb/overview/what-is-paas/ or https://azure.microsoft.com/en-gb/overview/what-is-saas/, (accessed on June 26th, 2021).

novelty, these emerging service models have not yet gained material traction yet, and as such, are not analysed further in this report.

12. Cloud services can also be categorised by deployment model. A cloud computing **deployment model** is defined according to where the infrastructure for the **deployment resides** and who has control over that infrastructure.

- **Public clouds** are environments that are managed, maintained, and administered by an external cloud service provider. Resources are available to all registered users, usually through a web browser.
- **Private clouds** are environments that are managed and maintained by the organisation that uses them. Generally, the infrastructure for the environment is housed in a datacentre that the organisation controls. Therefore, the organisation is responsible for purchase, maintenance, and technical support. In addition, the owner is also responsible for any software or client application installed on the end-user system.
- **Community clouds** are semi-public clouds that are shared between members of a select group of organisations, which typically have a common purpose or mission, allowing them to share the responsibilities of maintaining the cloud.
- **Hybrid clouds** are the most common cloud implementations, consisting of a combination of two or more other cloud deployment models. The clouds themselves are not mixed; instead, multiple separate cloud environments are connected. A hybrid cloud may introduce more complexity to the environment, but it also allows more flexibility in fulfilling an organisation's objectives.

13. A Flexera survey on cloud computing strategies in 2019 showed that 58% of enterprises deployed hybrid clouds, 27% public clouds, and 12% private clouds[19]. Data also show that international IT professionals use multiple cloud providers.[20]

1.1.2 Who are the customers of cloud computing service providers?

14. Enterprises, public sector entities and private individuals all benefit from cloud computing services. The customers of cloud computing services can be segmented according to different criteria:

- **Size:** whilst the European Commission has left definitions open for cloud computing, precedents in the software space[21] point to segmentations of firms into "mid-market" and "up-market" (large complex enterprises). Larger firms can use their bargaining power when comparing product offering by several providers, and may have the resources required to optimise their activities across a range of providers and deployment models.
- **Stage of adoption:** (i) *digital natives*, who started their business with a cloud service, and (ii) *migration businesses*, who rely on an in-house server or offline services and plan to migrate to the cloud. While migration businesses might

19 Flexera (2020), *Enterprise cloud strategy worldwide from 2017 to 2020,* by cloud type. Available via Statista at: https://www.statista.com/statistics/817296/worldwide-enterprise-cloud-strategy/, (accessed on June 26th, 2021).

20 Statista (2020), IT Services, https://www.statista.com/statistics/511467/worldwide-surveypublic-coud-services-running-application/.

21 European Commission (2004), Case No *COMP/M.3216-ORACLE/PEOPLESOFT*. Available at https://ec.europa.eu/competition/ mergers/cases/decisions/m3216_en.pdf, (accessed on June 26th, 2021).

care about preserving old habits (e.g. existing interface, database management software) and the smoothness of the transition (often referred to as "lift and shift"), digital natives focus more on latency or the integration with APIs.

15. The presence of an in-house IT department also changes the needs of customers. For instance, SMEs or migration businesses without a proper IT department might prefer a "one- stop shop" solution, integrating different services in a user-ready fashion. On the other hand, enterprises with an in-house IT department might find it optimal to tailor a solution using different services, for instance combining the storage capacity of one provider and the computation power of another.

1.2 RELEVANT MARKET DEFINITION FOR CLOUD COMPUTING

16. Market definition underpins all evaluations of the competitive dynamics in a market. In the case of potential abuses of dominance, the market definition is essential in assessing the dominance of a specific firm, demand and supply substitutability, the existence of competitors and their market shares.

17. Relevant markets are normally defined according to two dimensions: product and geography. The Commission's notice on the definition of the relevant market[22] states that a relevant product market comprises of all those products and/or services which are regarded as interchangeable or substitutable by the consumer, by reason of the products' characteristics, their prices and their intended use.

18. As discussed, the market for cloud computing encompasses a large variety of products, each with varying degrees of substitutability and product characteristics. These can change with service model, industry need and licensing/bundling arrangement. Furthermore, the high degree of customisation of cloud services imply that large-scale users may each require specialised packages from providers.[23] This - and the lack of precedent in such a definition - makes defining the relevant market a particularly difficult exercise.

19. In the most recent decision addressing a potential definition of IaaS-SaaS markets (*Microsoft/GitHub*[24]), Microsoft took the stance that IaaS and PaaS should form part of an overall market, on the grounds of supply substitutability. From Microsoft's perspective, cloud providers have gradually expanded their service offerings in order to provide customers a broad range of solutions, and as such would be capable extending supply either through in- house expansion or subcontracting arrangements with other providers. The Commission ultimately left the decision open, given that the merger did not raise anti-competitive concerns.

20. However, in past decisional practices, we may note that the Commission had traditionally seen service type as an important segmenting criteria. For example, in *IBM Italia/UBIS* [25], the Commission considered the IT Outsourcing market as

22 European Commission (1997), *Commission Notice on the definition of relevant market for the purposes of Community competition law* (97/C 372/03). Available at https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX: 31997Y1209(01)&from=EN, (accessed June 28th, 2021).

23 Slujis et. Al. (2012), Cloud Computing in the EU Policy Sphere. Available at www.jipitec.eu/issues/jipitec-3-1-2012/3320/sluijs.pdf, (accessed June 28th, 2021).

24 European Commission (2018). Case *Microsoft/GitHub*, COMP/M.8994. Available at https://ec.europa.eu/competition/mergers/cases/decisions/ m8994_257_3.pdf, (accessed on Jun 26th, 2021).

25 European Commission (2013). Case *IBM Italia/UBIS*, COMP/M.6921. Available at https://ec.europa.eu/competition/mergers/cases/decisions/ m6921_304_2.pdf, (accessed on Jun 26th, 2021).

distinguishable, by service type, into (a) public cloud computing services, (b) infrastructure as a service (IaaS), (c) infrastructure outsourcing services, and (d) application outsourcing services. The Commission had pointed to elements from the demand side that were suggestive of a separate market for infrastructure outsourcing services, with potential further sub-segmentations within this market. A similar conclusion was reached in IBM/INF Business of Deutsche Lufthansa[26].

21. Equally, in a 2011 case between *Computer Sciences Corp/iSOFT Group*, the Commission determined that software products could be segmented by their position on the 'IT stack': (i) infrastructure software (i.e. servers and databases), (ii) middleware (i.e. integration platforms), and (iii) application/office software (i.e. productivity and collaboration tools). Here, we may note that just as software products are distinguishable by its respective infrastructure, platform and software end-uses, cloud services could be considered in a similar manner.

22. In addition to decisional practices, there are substantive motives as to why it may be inappropriate to consider IaaS–PaaS–SaaS as part of one whole relevant market. Firstly, there is little evidence to suggest that demand substitutability is high across the three service models. Typically, end users exhibit very different needs: for example, Infrastructure as a Service (IaaS) customers may prioritise computational power, PaaS users integrated development capabilities, with SaaS customers favouring accessibility and user-friendly solutions.

23. Secondly, evidence points to limited supply substitutability between these markets:

- cloud providers are often specialised in certain product segments, with diminished ability to quickly manoeuvre and deploy services in adjacent markets;
- as discussed, cloud providers typically exhibit differing levels of integration along the cloud supply chain, requiring complementary software products to run their solutions on;
- given that most cloud providers rely on special licensing and subcontracting arrangements to complement their offering, restrictive practices from the big software players may imply that their ability to provide a full range of services to customers may be limited.

24. A further dimension to take into consideration is the choice between on-premise and cloud, in conjunction with the customer's main end use. It is unlikely, for example, that a management consultancy would see DevOps tools as a substitute for productivity software. It is however more plausible that a current user of on-premise productivity software may be considering the cost of licensing such software (as opposed to the cloud-based version of such software by the integrated provider) as a fundamental factor when deciding on the transition to the cloud.

25. Based on this evidence, we submit that IaaS – PaaS – SaaS cannot be considered as part of one relevant market. We adhere to the Commission's prior practices, which suggested service model as an important segmenting criterion of individual markets, but we also remark that complementary software to be deployed on the cloud infrastructure can substantially vary across users, providing reasons for establishing even finer relevant market classifications.

26 European Commission (2014). Case *IBM/INF Business of Deutsche Lufthansa,* COMP/M.7458, Available at https://ec.europa.eu/competition/mergers/cases/decisions/m7458_20141215_20310_4043465_EN.pdf, (accessed on June 26th, 2021).

26. Looking at the relevant geographic dimension for this market, the European Commission has thus so far left the definition open, given that the transactions in question were not susceptible to affect the internal market under any geographic definition. In some previous cases, the Commission took the view that the market for cloud computing services is at least EEA-wide[27]. However, in some cases, such as Cap Gemini/BAS [28], the Commission considered that the market was national due to some IT providers operating exclusively at the national level.

1.3 *THE ADJACENT PRODUCTS TO CLOUD COMPUTING SERVICES*

27. As mentioned earlier in this section, in addition to the various cloud computing service offerings, when choosing a cloud provider, customers may also consider the availability of complementary products in adjacent product segments. Most of these products are software components, which sometimes can be acquired via integrated PaaS or SaaS solutions, but can also be purchased separately and then integrated with an existing cloud infrastructure solution. The compatibility, level of integration and cost of these separate software components may be an important input into the customer's decision as for which cloud infrastructure service provider to recur to.

28. As such, the analysis of the position of key cloud infrastructure competitors on adjacent software segments is very important, as a number of the firms offering cloud solutions are "integrated providers" who also offer a broader array of products, while other "naked providers" are only active in cloud computing and instead must sub-license additional software to be installed on their clouds. The ability of a firm to offer an integrated solution may affect how it competes in the market for cloud infrastructure services, as a strong position of a firm in adjacent software segments may allow it to behave anti-competitively in the segment of infrastructure solutions. In this section, we briefly set out several adjacent products with strong ties to cloud services.

1.3.1 What products are adjacent to cloud computing services?

29. The following adjacent products are those most often combined with cloud computing services:

- **Productivity software** provides application software to support business activities operated on a computing device. It helps employees optimise their workflow using various employee-friendly, reliable, and compatible tools for analysis. For instance, some of the most popular productivity software programs among businesses are Microsoft Office 365,[29] Google Workspace and apps for business, Zoho, Adobe online services and HyperOffice. The major players are

27 European Commission (2011), Case M.6237 Computer Sciences Corporation/iSoft Group. Paragraphs 17 to 18. Available at https://ec.europa.eu/competition/mergers/cases/decisions/m6237_20110620_20310_1850463_EN.pdf, (accessed on June 28th, 2021); et European Commission (2014), Case M.7458 IBM/INF Business of Deutsche Lufthansa. Paragraph 32, available https://ec.europa.eu/competition/mergers/cases/decisions/m7458_20141215_20310_4043465_EN.pdf, (accessed June 28th, 2021).

28 European Commission (2008), Case M. 5301 Capgemini/BAS. Paragraph 19, available at https://ec.europa.eu/competition/mergers/cases/decisions/m5301_20081013_20310_en.pdf, (accessed on June 28th, 2021).

29 Microsoft Office 365 can be run either locally (e.g., downloaded and installed apps) or via cloud infrastructure as a SaaS.

Microsoft, Google, Oracle and SAP.[30] However, Microsoft and Google are far bigger than their competitors. Today, Microsoft's Office accounts for 87.5% of the revenue generated by in this market, while Google's G Suite accounts for 10.4%.[31]

- **Operating systems (OS)** manage other software and hardware on a device, providing common services for programs and generally allowing the computer (or smartphone) to run. Google's Android and Apple's iOS are the largest worldwide mobile operating systems for smartphones, and Microsoft's Windows, Apple's MacOS and Linux are the largest operating systems for laptops and desktop computers. Globally, Microsoft Windows remains the most widely adopted OS, accounting for more than 70% of the desktop, tablet, and console OS users as of September 2020.[32] Windows is adopted by a wide majority of users of desktop PCs (more than 75% as of July 2020).[33] Among smartphones, Google's Android and Apple's iOS are the largest worldwide mobile operating systems. The share of Android is projected to be adopted by around 70% of users, while the share of iOS sits at about 28%.[34] Google's strong position is more nuanced for tablets: in the second half of 2020, about 58% of all tablets worldwide used iOS and 41% used Android.[35]

- **Database management systems (DBMS)** provide a platform through which developers can organise, update, and control large databases. While some of the leading firms in the software industry, such as Microsoft (Microsoft SQL Server, Microsoft Access), Oracle (Oracle Database) and IBM (Db2), offer database management software, a range of free and open source DBMSs such as PostgreSQL and Apache Cassandra offer competitive alternatives.[36] Oracle, with its multiple offering (Oracle RDBMS, and the open-source MySQL), and Microsoft with SQL Server are the leaders for database management.[37] Oracle is the most adopted solution, being used by more than 45% of database management users,[38] but Microsoft has been investing heavily in this segment and has recently introduced AI capabilities[39] into SQL Server over Azure.

- **Sharing and storing services**, such as Dropbox or iCloud, allow users to keep their data on the cloud instead of physical hard drives and to access them remotely. Enterprise level storage solutions, for example Elastic Block Store by

30 Mordon Intelligence (2019). *Business Productivity Software Market, growth trends and forecast (2020-2025).* Available at: https://www.mordorintelligence.com/industry-reports/global-business-productivity-software-market, (accessed on June 26th, 2021).

31 CIODive (2020). *Microsoft created the office suite status quo. Can Google grow?*. Available at: https://www.ciodive.com/news/Google-Microsoft-Office-collaboration/571740/, (accessed on June 26th, 2021).

32 Statista (2020). *Global market share held by operating systems since 2009.* Available at: https://www.statista.com/statistics/268237/global- market-share-held-by-operating-systems-since-2009/,(accessed on June 26th, 2021).

33 Statista (2020). *Operating Systems - Statistics & Facts.* Available at: https://www.statista.com/topics/1003/operating-systems/, (accessed on June 26th, 2021).

34 Statista (2020), *Mobile Operating System Market Share Worldwide.* Available at https://www.statista.com/statistics/272698/global-market-share-held-by-mobile-operating-systems-since-2009/, (page accessed on June 26th, 2021).

35 Statcounter Globalstats (2020). *Tablet Operating System Market Share Worldwide.* Available at: https://gs.statcounter.com/os-market-share/ mobile/worldwide, (page accessed on June 26th, 2021).

36 DB-Engines (2020), *Ranking of the most popular database management systems worldwide, as of June 2020.* Available via Statista at https://www.statista.com/statistics/809750/worldwide-popularity-ranking-database-management-systems/ (accessed on June 26th, 2020).

37 *Ibidem*.

38 Statista (2020), *Database software, statistics and facts.* Available at: https://www.statista.com/topics/5157/database-software/, (accessed on June 26th, 2021).

39 Analytics Insights (2020). *What do SQL server statistics tell you?*. Available at: https://https://www.analyticsinsight.net/what-do-sql-server-statistics- tell-you/, (accessed on June 26th, 2021).

Amazon or OneDrive by Microsoft can be offered with other cloud computing products as part of an integrated product offering. This product segment has seen some fierce competition in the recent years. Today, the most used service is Apple's iCloud, followed by Dropbox, Microsoft's One Drive and Google Drive.[40] Microsoft's One Drive is the default cloud storage service for Windows 10 users; similarly, One Drive for Business is the standard for Office365 users. In this segment, Microsoft is carefully creating hardware connections: Microsoft's key hardware pieces, Surface, are seamlessly linked to OneDrive[41] and Microsoft has a partnership with Samsung to offer free OneDrive with some Samsung smartphones.[42] Moreover, the autosave function on Office 365 products can be enabled only through One Drive.[43]

- **Collaboration tools** allow users to communicate, share data and information promptly and organise their teamwork. This segment is evolving rapidly and recent acquisitions lead to a further consolidation. Some of the most popular players are Skype, acquired by Microsoft in 2011; Microsoft Teams, recently integrated with no extra cost into Microsoft's Office 365 bundle,[44] and Slack, which was launched initially in 2013 and went public in 2019. Microsoft's Office365 also includes SharePoint, which enables multiple individuals to work on the same document at the same time, and was over time integrated with One Drive.

- **Virtualisation and orchestration software** allow portability and integration between different cloud ecosystems. For instance, Kubernetes and Docker allow for the development, deployment and maintenance of applications to be independent of the specific IaaS or PaaS service used. Use of these programs allows for portability of applications as most IaaS and PaaS services are built to be compatible with these systems.[45] This product segment is somewhat different from the others as it is characterised by open source projects with high velocity and global adoption. Kubernetes, for example, was developed by Google but is currently governed by the Cloud Native Computing Foundation. Whilst Kubernetes is originally conceived as open-source orchestration tool, many vendors then develop their own branded version. Microsoft only recently (April 2020) became qualified as Kubernetes Certified Software Provider and fully developed all capabilities under the Azure Workloads for Containers. Docker and Apache Mesos are other similar and widely used orchestration tools.

40 Software Testing Help (2020), 10 *BEST Free Cloud Storage Providers (Online Storage 2020).* Available at: https://www.softwaretestinghelp.com/ cloud-storage-providers/, (accessed on June 26th, 2021).

41 CB Insights (2018). *Microsoft Strategy Teardown: Cloud, AI, & Subscriptions And The Next Trillion-Dollar Company.* Available at: https://www.cbinsights.com/research/report/microsoft-strategy-teardown/, (accessed on June 26th, 2021).

42 See Samsung support, *How to redeem free storage of OneDrive.* Available at https://www.samsung.com/levant/support/mobile-devices/how-to-redeem-free-storage-of-onedrive/#helpHtg1callOrder0_0, (page accessed on June 26th, 2021.)

43 See Microsoft Answers. Accessed at https://answers.microsoft.com/en-us/msoffice/forum/msoffice_word-msoffice_custom- mso_2016/how-to-autosave-local-to-pc-instead-of-to-onedrive/8631fa3c-3af4-49f7-8f83-b80c3f3389e8, (accessed on June 26th, 2021).

44 The Verge (2020), *How Microsoft crushed Slack.* Available at https://www.theverge.com/22150313/how-microsoft-crushed-slack-salesforce-acquisition, (accessed on June 26th, 2021); et European Commission (2020), *Case Study 9 of the European Commission Digital Markets Act - Impact assessment support study - Annexes.* Available at https://op.europa.eu/en/publication-detail/-/publication/2a69fd2a-3e8a-11eb-b27b-01aa75ed71a1 / language-en, (accessed on June 26th, 2021)

45 See for example Microsoft website, *Kubernetes vs. Docker.* Available at https://azure.microsoft.com/en-us/topic/kubernetes-vs- docker/#:~:text= Docker%20Swarm.&text=A%20fundamental%20difference%20between%20Kubernetes,production%20in%20an%20efficient%20manner, (accessed on June 26th, 2021).

- **Developer Frameworks** are environments that contain compilers, code libraries, toolsets, and APIs, bringing together all the components necessary to develop a project. JavaScript, Ajax, Oracle ADF and Microsoft are some of the most used frameworks. Microsoft has recently announced plans to unify its developer ecosystem.

30. In addition to these products, there are multiple other software segments that can be deployed via cloud computing, and therefore may be adjacent to the cloud computing market, including (Table 2):

Table 2: Adjacent software examples

Adjacent software examples			
	Definition	**Examples**	**Microsoft's offering**
Business intelligence software	Allow data visualisation and the creation of dashboards to help firms derive insights from their data.	Tableau or Power BI	PowerBI
Customer relationships management	Help in managing the interaction between a firm and its clients, for instance focusing on customer retention and targeted campaigns	Salesforce	Dynamics
Identity and access management	A framework of usiness processes, policies and technologies used to authenticate electronic identities, i.e. usernames and passwords. It is the practice of proving, granting, and controlling user access to systems and critical information within an organisation	Okta, Ping Identity	Active Directory (on-premise) and Azure AD (cloud)
Cloud system and service management software	Help companies integrate software and technology in a way that handles cloud environments. Solutions allowing for simple and effective integration of cloud infrastructure across different environments are driving the global demand for cloud system management	VMware vRealize Red Hat	Azure Cloud Service Management

31. Microsoft is the only cloud provider that also offers products in all of these other segments. Indeed, Power BI is considered as one the industry leaders of business intelligence software;[46] whilst Dynamics holds the second biggest share of the customer relationship management segment at 22%.[47] Furthermore, it is also the second largest provider with around 14% of the cloud management software segment;[48] finally, Microsoft's AD is recognised as one of the leaders of identity and access management software.[49] IBM also offers cloud management, business

46 Edureka (2019). *Power BI vs Tableau : Which One Would You Choose?".* Available at https://www.edureka.co/blog/power-bi-vs- tableau/, (page accessed on June 26th, 2021).

47 Statista (2015). *Which CRM do you currently use?* Available at https://https://www.statista.com/statistics/495063/united-states-top-industries-using-crm, accessed on June 26th, 2021).

48 See,for example, VMware webpage: https://www.vmware.com/content/microsites/learn/en/571311_REG.html, (page accessed on June 26th, 2021).

49 See, for example, Microsoft webpage: https://www.microsoft.com/security/blog/?p=92153, (page accessed on June 26th, 2021). Note that Microsoft also offers an on-premise version of identity management software, called Microsoft Active Directory.

intelligence and identity and access management software, while Oracle is only present in these last two segments.

1.3.2 What adjacent services complement cloud computing services?

32. As discussed in Section 1.1.2, cloud computing service providers have clients with a wide range of needs. Such client requirements will in turn define the types of adjacent services needed by, and the level of complementarity experienced by, a specific customer of a cloud computing service provider.

33. The hypothetical scenarios below are provided to illustrate the specificity of such customer experiences:

- When a **migration business** (e.g. a **small accounting firm**) considers transitioning to the cloud for the first time, the firm's priorities likely include ease of transition and integration to minimise disruption to its employees (and potentially to end-clients). For example, they might want to preserve their productivity software (likely Word and Excel), and their operating system (likely Windows) on the virtual machines, and they will also likely require cloud storage capacity and collaboration tools. If they have some back-end database to migrate, this process could mean that they are tied to a specific database software, as switching costs might be high.
- For a **digital native** firm (e.g. an **e-commerce website**) performance, computational power and scalability may be more important concerns. For example, it may value flexible computational power to handle all open sessions and fulfil orders seamlessly, and scalability to handle surges (e.g. first day of sales) without having to pay for the maximum capacity for the whole year. They may also require database management tools to manage inventory in real-time. Digital native firms tend to be sophisticated consumers of cloud computing services and may be more likely to mix service offerings from one or more providers and be more willing to switch providers than migration businesses.

34. The scenarios highlighted above show the strong interconnection between cloud services and adjacent product segments. In many cases, there can be a perfect complementarity between IaaS or PaaS services and some other software: for instance, a virtual machine might not be usable without an operating system.

35. In all of the scenarios, clients can "multi-cloud", i.e., purchase different services from different providers, for instance renting virtual machines with a certain provider, and paying a licence to Microsoft for a Windows licence. However, it is also common for cloud providers to sub-license software and offer a package including licences for third-party products.

36. As a result, it is important to distinguish between naked cloud providers who only offer cloud infrastructure services without any proprietary software of their own and who do not operate directly on adjacent product segments, from integrated cloud providers who offer cloud infrastructure service and license some of their own software. Importantly, the more the software of those integrated providers hold strong positions in adjacent market segments and are required by the IT users, the larger the impact of potential anti-competitive practices may be, causing distortions in the cloud infrastructure services market.

2

Theoretical assessment of potential anti-competitive behaviours in the cloud computing market

2 THEORETICAL ASSESSMENT OF POTENTIAL ANTI-COMPETITIVE BEHAVIOURS IN THE CLOUD COMPUTING MARKET

37. The previous section highlighted the presence of a strong connection between certain cloud services markets and other products markets – notably software. We also notice that some of these software are either deployed as integral components in SaaS, or complements to services like IaaS, which might raise vertical competition concerns.

38. In this section, we begin by setting out a range of anti-competitive practices that could be employed in the cloud computing infrastructure sub-segment before examining how these could lead to negative impacts on competition and the economy as a whole. In particular, we examine the practices that could be adopted by integrated cloud service providers with strong positions in the software market adjacent to cloud infrastructure which could be used to limit competition between cloud infrastructure service providers (integrated and naked), to the detriment of customers.

2.1 POTENTIAL ANTI-COMPETITIVE PRACTICES

39. The strong links between IaaS/PaaS services and certain product segments on adjacent product segments (i.e., software discussed in Section 1.3) could allow the developers of popular products to leverage their market power in adjacent product segments to distort competition in cloud infrastructure markets. This section outlines some of the possible anti-competitive behaviour and it focuses on practices that rely on market power on adjacent product segments. These include, inter alia, bundling, tying, raising rivals' costs, self-preferencing and other on price-related practices like predatory pricing.

40. It is important to note that in this market each customer has a specific need in terms of software components, which might define the degree up to which they might be captive from a specific provider. Therefore, anti-competitive practices can be relevant for only a subset of customers.

2.1.1 Bundling

41. As highlighted above, integrated cloud providers offer services that naked providers cannot. For instance, while a naked provider must license proprietary software from an external company, an integrated firm can sell its cloud infrastructure services together with a complementary software. This practice, commonly referred to as bundling, may have anti-competitive implications if it is enacted to exclude efficient competitors.

42. For instance, an *integrated* cloud provider may decide to offer its bundle (i.e. the software combined with its cloud infrastructure services) for a relatively lower price, while offering its software licences alone for a relatively higher price – this is referred to as "mixed bundling". This way, naked cloud infrastructure providers, who must license the software alone, would face a comparative disadvantage, as

customers choosing their cloud infrastructure services will face a higher total cost than those customers who opt for the integrated provider's bundle. If the software in question is essential for the functioning of the cloud infrastructure service, naked providers may even be forced to shut down. Therefore, a company with market power on an essential software product segment could leverage it to take over the cloud infrastructure market segment.

2.1.2 Tying, raising rivals' costs and self-preferencing

43. Similarly, integrated cloud providers may choose to create technical, legal, or economic links between their cloud infrastructure services and other software products, making them difficult or impossible to use without the other. This practice, known as *tying*, happens when software providers specify (legally or technically) that their software must be run on their own cloud infrastructure services. For instance, an integrated provider may optimise its software to work on a specific cloud infrastructure service, and be very slow and inefficient on other cloud infrastructure services. While in principle everybody could use the software, de facto its use would be limited to same-brand cloud infrastructure services.

44. Additional conducts to a similar effect are known as "raising rivals' costs" and "self-preferencing". The former refers to strategies aimed at inducing rivals to exit (or at least to perform much less efficiently) by raising their costs. In the context of the cloud infrastructure, additional licensing requirements imposed by integrated providers onto rivals requiring their software can be considered as an example of these strategies. Too frequent and unstable updates could also be an effective way to increase rivals' costs: indeed, if patches are released frequently and need a good amount of work to grant interoperability, rivals' services will need to incur high levels of expenditures to debug and provide a stable service. The practice consisting in refusing to allow other cloud infrastructure providers to obtain a certification that the software is secure when run on those other cloud infrastructure providers (integrated or naked) also increases rivals' costs. In this regard, the effects of tying and "raising rivals' costs" can be considered to be very similar, as interoperability is ultimately limited, with adverse effects on the quality of the service.

45. Self-preferencing can be considered as the mirror image of such practices, and pertains to giving preferential treatment to one's own products or services when they are in competition with products and services provided by other entities using the platform. For this reason, it is most often cited in the context of vertically-integrated platforms competing with third party sellers.

46. As in the case of bundling, if the software is essential for the client, or if speed is of paramount importance (e.g. latency being a crucial feature for financial institutions), naked cloud providers are de facto excluded from the market by the integrated provider as the quality of their services is inevitably degraded by the low interoperability.

47. Due to the potential for excluding competitors by companies engaging in tying and bundling practices, the Commission may intervene to curtail such practices under the following conditions.[50]

50 *European Commission (2009), Communication from the Commission - Guidance on the Commission's enforcement priorities in applying Article 82 of the EC Treaty to abusive exclusionary conduct by dominant undertakings.* Official Journal of the European Union. Available at: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2009:045:0007:0020:EN:PDF, (accessed on June 26th 2021).

- The firm is dominant, at least, in one product market that is part of the tie or bundle.
- The tying (e.g. productivity software) and tied products (e.g. IaaS infrastructure) are distinct products. Two products can be considered as distinct if, in the absence of tying or bundling, an important number of clients would purchase the tying product without also buying the tied product from the same supplier.

48. While the two above are necessary conditions, the Commission considers the following factors when assessing the likelihood of such anti-competitive foreclosure. For each point, we briefly discuss why this might apply to cloud computing services under the lens of the Commission's Guidance:[51]

- The stronger the dominant undertaking relative to its competitors (indicated, e.g. by a high market share of revenue held for a long time), the higher the likelihood that conduct protecting its position will lead to anti-competitive foreclosure.
  - Microsoft is dominant in productivity software and operative system and it has a strong position in multiple other adjacent product segments, such as identity management (Active Directory [52]), collaboration tools (Teams and Skype), database management (SQL Server) and sharing and storage software (One Drive). Its strength in these segments has been almost unchallenged in the last 20 years. Its importance as a cloud computing provider is also well-established.
  - Oracle has a very strong position in the database management software product segment. The high switching costs could, however, lead to a lock-in situation in which transitioning from Oracle to competitors' databases might be very costly.[53]
- A sudden increase in the adjacent market share by the dominant undertaking may imply that competitors have already been marginalised because of the anti-competitive behaviour.
  - As shown in detail in the Annex to this report, Microsoft is growing rapidly, largely out-performing other cloud infrastructure services players in the market. As a result, the market may be characterised as becoming increasingly concentrated.
- High entry barriers (including economies of scale, network effects, and ability to target key customers/suppliers with the tying/bundling) on the relevant market may allow the dominant undertaking to reinforce its position, as it could be costly for them to overcome possible foreclosure through vertical integration.
  - Barriers to entry in some adjacent markets are evident: Microsoft Office has been the leading productivity software for decades and it has remained so even in the face of substantial investment by other large software providers (e.g., Google's investment in the competing office productivity software Google Docs). Similarly, the IaaS market has some important barriers to entry, as it is a capital-intensive R&D driven sector.

51 *Ibidem.*

52 We remark here and elsewhere that Microsoft offers both an on-premise and a cloud version of these applications, and it is already dominant on the on-premise segment.

53 InfoQ (2016), *Everything Is "Lock-In": Focus on Switching Costs.* Available at https://https://www.statista.com/statistics/495063/united-states-top- industries-using-crm, (accessed on June 26th, 2021).

- The longer the duration of the tying or bundling "contract", and the larger the number of products included in the bundle, the higher the risk of foreclosure.
  - Technical tying is a concrete concern as switching costs between different software (e.g. productivity or database management software) can be high.[54] Microsoft proposes an extremely vast portfolio of products that often are integrated (see Section 3.1.2 for a more detailed discussion). Microsoft also sets licensing surcharges for users wishing to exploit their licences on rival clouds.
- Multi-product rebates, in either the tied or the tying market, are anti-competitive if they imply that equally efficient competitors supplying only one of the markets cannot compete against the discounted bundle.
  - While this should be discussed further and analysed empirically, the increase in licensing costs discussed in Section 3.1.1 seems to confirm that this may be a concern.

49. One possible test to assess the presence of anti-competitive bundling, outlined by the Commission in its policy guidance, is to examine whether the incremental price that customers pay for each of the dominant undertaking's products in the bundle is below the long-run average incremental cost (LRAIC)[55] of the dominant undertaking from including that product in the bundle. In such a case, an equally efficient competitor might be prevented from entering or growing.[56]

2.1.3 Predation

50. Integrated cloud providers may be able to cross-subsidise cloud computing offerings by utilizing profits from other markets to offset a potential loss from their cloud infrastructure services. Integrated providers would therefore have the means to engage in the anti-competitive behaviour known as "predatory pricing" by providing their cloud infrastructure services at unsustainable prices with the aim to drive competition out of the market (and increase prices once competition has been removed).

51. Predatory pricing is particularly relevant in the cloud infrastructure services market due to its high barriers to entry: it requires a high capital investment in physical server structures, high R&D costs to develop new solutions and to keep up with the rapid growth of the market and its increasingly high requirements, as well as economies of scale to reduce unitary costs. Indeed, cloud computing infrastructure customers may not require a constant amount of computing power, as their demand fluctuates over time (for instance, an e-commerce website will require increased resources during the holiday season, while a food-delivery app may require additional resources during lunch or dinner). Having a large and diversified portfolio of clients allows cloud infrastructure providers to satisfy the needs of many customers with a lower server investment, as final customers share the same infrastructure. Economies of scale are thus vital for profitability, as they allow to

54 *Ibidem.*

55 Long-run average incremental cost is the average of all the (variable and fixed) costs that a company incurs to produce a particular product.

56 This is relevant only if competitors are not able to sell the same bundles. Notice that if they can sell identical bundles the Commission will generally address this as a bundle competing against a bundle, in which case the mentioned test is no longer relevant.

recoup the fixed costs of building servers more easily. Through very aggressive or predatory pricing, integrated cloud providers could prevent new competitors to reach a critical mass of clients that would allow them to reach profitability. Naked cloud providers, in the face of such high entry and maintenance costs, may therefore unable to match below-costs predatory prices that may be offered by some integrated cloud providers with a strong position in the adjacent software market segment.

2.1.4 Effects on innovation

52. From the first stages as an efficient data storage solution, cloud computing has rapidly evolved into a plethora of products and platforms for generating data and innovative approaches to leverage that data. Service and provider choice are of paramount importance in ensuring that customers obtain the best possible product for their needs when undertaking their digital transition. But given that this need for customised solutions will remain even in a fully cloud native world, it is important to preserve the competitive dynamics of this vibrant and still relatively young industry.

53 The potential risks on innovation are highlighted in Condorelli and Padilla (2020):

"[...] platform markets often evolve, not through Schumpeterian innovation (that is, though the addition of new functionalities to existing products or the launch of totally new products or services), but rather through the leveraging of market power, user base, and resources into a target market by a platform who is already successful in another platform market (the origin market)."[57]

54. If a large integrated cloud provider (such as Microsoft) were to prevent its competitors from entering or expanding, this could have devastating consequences for innovation on the cloud infrastructure services market, and as a result on the economy as a whole. Given that small providers may develop technologies and new functionalities that have the potential to foster the growth of this market, if a dominant firm prevents them from expanding (or worse, forces them to exit the market), this will eventually reduce incentives for engineers to develop new solutions and for firms to market new products.

57 Condorelli, D. et. Padilla, J. (2020). *Harnessing Platform Envelopment in the Digital World.* Journal of Competition Law & Economics, 16(2), 143-187.

55. Bundling practices can also prevent the entry of potential competitors, by raising the entry costs in the market. According to Choi and Stefanadis (2001), *"The key observation is that entry is often risky. That is, for instance, to enter the market, a firm might need to invest in R&D, but ultimately it is not certain of being able to produce a valid innovation. If this is the case, then bundling by the enveloper increases (non-additively) the overall risk of entry, thus reducing the value of succeeding in any given market, as success in a single market is not sufficient to allow the entrant to recoup its fixed costs."*[58] Therefore, by bundling different services, a new entrant would need to develop an innovative product not only on one market, but on the whole portfolio needed for the ecosystem to run.

56. In conclusion, as cloud services are becoming the strategic backbone of the digitalisation strategy of many industries, the potential harm to the cloud market could have serious spill-overs to the whole economy. By slowing down research and limiting competition, these practices could harm global growth well beyond the cloud services markets.

58 Choi, J. P. et Stefanadis, C. (2001). *Tying, investment, and the dynamic leverage theory.* RAND Journal of Economics, 52-71.

3

Evidence of anti-competitive behaviours by integrated cloud service providers

3 EVIDENCE OF ANTI-COMPETITIVE BEHAVIOURS BY INTEGRATED CLOUD SERVICE PROVIDERS

57. Some of the recent behaviour of large integrated cloud providers, notably Microsoft and Oracle, can fit into the anti-competitive framework outlined above. In this section, we highlight some concrete behaviours that may cause anti-competitive concerns. The first section details evidence arising from publicly available sources as well as the examples provided by cloud services providers, while the second section summarises the findings of our in-depth interviews with various cloud services customers.

58. There is a long history of anti-competitive behaviour by established and integrated technology providers in response to new technologies being introduced. *"Early examples include Microsoft entering the streaming media and browser markets, at the time dominated by Real Media and Netscape, respectively. Microsoft entered by bundling Windows with its new products, Windows Media Player and Internet Explorer, which at the outset were arguably inferior to those provided by the incumbents. Nonetheless, Microsoft quickly managed to conquer those markets and drive out the rivals"*[59]. More recently, Slack has brought forward a complaint against Microsoft due to the bundling of Office with Teams in the cloud-based Office 365 solution. This strategy would have enabled Microsoft to leverage its cloud-based services as a way to strengthen its collaboration tools product.[60]

59. Microsoft has experienced extraordinary growth as a cloud infrastructure services provider (IaaS). As highlighted in the Annex of this report, over the past 5 years, the share of its cloud infrastructure platform sales, Azure, has grown by more than eight times, arriving at almost 18% today. Simultaneously, Microsoft continues to enjoy a very strong position in several product segments adjacent to cloud services, most notably in operating systems (e.g. Microsoft Windows), office productivity software (e.g., Office 365 suite), collaboration tools (e.g. Microsoft Teams), software development tools (e.g. Visual Basic Studio), and database software (e.g. Microsoft SQL Server). Based on its position in these adjacent product segments, there are a number of strategies that Microsoft is capable of undertaking which may lead to anti-competitive effects.

60. As 'The Economist' points out, Satya Nadella, CEO of Microsoft *"put Microsoft's cloud- computing [...] at the heart of the business"*[61] since 2014,and adds that *"Microsoft cannot afford to get Azure wrong. It is what drives its share price"*.[62]

61. Financial analysts also agree that "*[o]ver the last several years, Oracle has transitioned from an antiquated business of on-premises database software licensing and maintenance to a subscription-based software model that taps*

59 *Condorelli, D., et Padilla, J. (2019). Harnessing Platform Envelopment Through Privacy Policy Tying*. Available at SSRN 3504025.

60 Publications office of the EU (2020). *European Commission Digital Markets Act - Impact assessment support study – Annexes; Case Study 9.* Available at https://op.europa.eu/en/publication-detail/-/publication/2a69fd2a-3e8a-11eb-b27b-01aa75ed71a1/, (accessed on June 26th, 2021)

61 The Economist (2020), *Briefing Microsoft - after the reboot.* Available at www.economist.com/briefing/2020/10/22/how-satya-nadella-turned-microsoft-around, (accessed on June 26th, 2021).

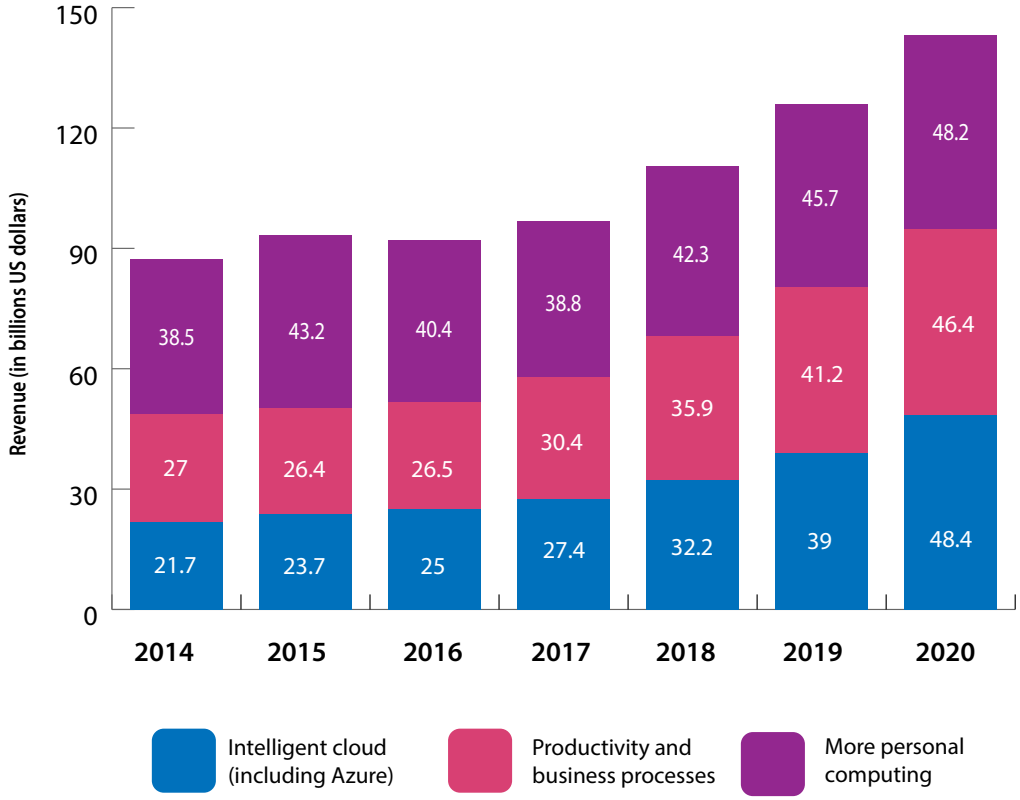
62 *Ibidem.*

the benefits of cloud computing".[63] This strategy was implemented through the acquisition of NetSuite and Aconex in 2016 and 2017, which were both cloud-based software providers that enriched Oracle's portfolio. Oracle recently became the cloud computing infrastructure provider of Zoom, winning the contract over more established providers like Amazon and Microsoft.[64]

62. While each of the major integrated cloud providers record their revenues earned from cloud services in different ways, Figures 2 to 4 below highlight the importance that cloud services represent to each. The pivotal role of cloud computing for these firms, previously known for other services, can be seen if we analyse their revenues. For instance, Microsoft's revenue growth has been in large part fuelled by its cloud services.

63. As Figure 2 shows, while cloud services represented roughly one quarter of Microsoft's revenue in 2014, they now account for more than one third of its revenue (more than productivity and personal computers, which have been its core business since the launch of the company). This rapid growth highlights on the one hand how important cloud services are for Microsoft; on the other hand, it also suggests that this growth - well above the market average - might have been due to Microsoft's presence in adjacent product segments. The effects of the anti-competitive practices that we discuss in this section might thus be materialising very rapidly.

Figure 2: Microsoft's global revenue by segment (2014-2020*, in billion U.S. dollars)



Source: Microsoft's Q420 earnings release [65]. Notes: *Fiscal years.

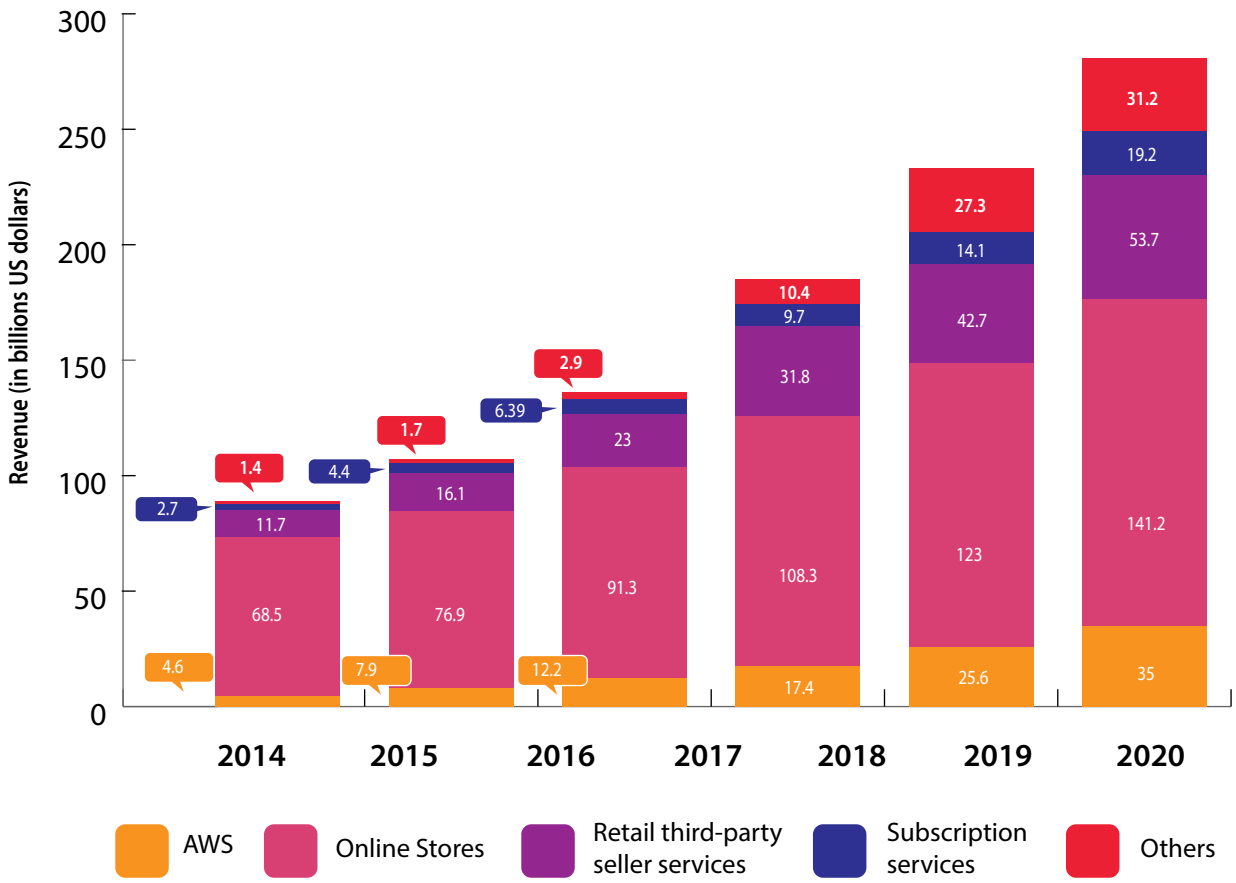
63 Investor's Business Daily (2020). *Is Oracle Stock A Buy Right Now? Here's What Earnings, Charts Show.* Available at https://www.investors.com/news/technology/oracle-stock-buy-now/, (accessed on June 26th, 2021).

64 Reuters (2020), Oracle wins cloud computing deal with Zoom as video calls surge. Available at https://www.reuters.com/article/us-oracle-zoom-video-commn-idUSKCN22A1R9, (accessed on June 26th, 2021).

65 Statista (2020), *Microsoft's revenue from 2012 to 2020 financial years, by segment*. Available at https://www.statista.com/statistics/ 273482/segment-revenue-of-microsoft/, (page accessed on June 26th, 2021).

64. Similarly, AWS took on a very important role within Amazon's strategy, with revenue growing by 8 times between 2014 and 2019. However, the operating margin on AWS is much higher than on the other sides of Amazon's business,[66] which makes cloud computing even more central to Amazon's profit-generation.

Figure 3: Amazon's global revenue by segment (2014-2019, in billion U.S. dollars)



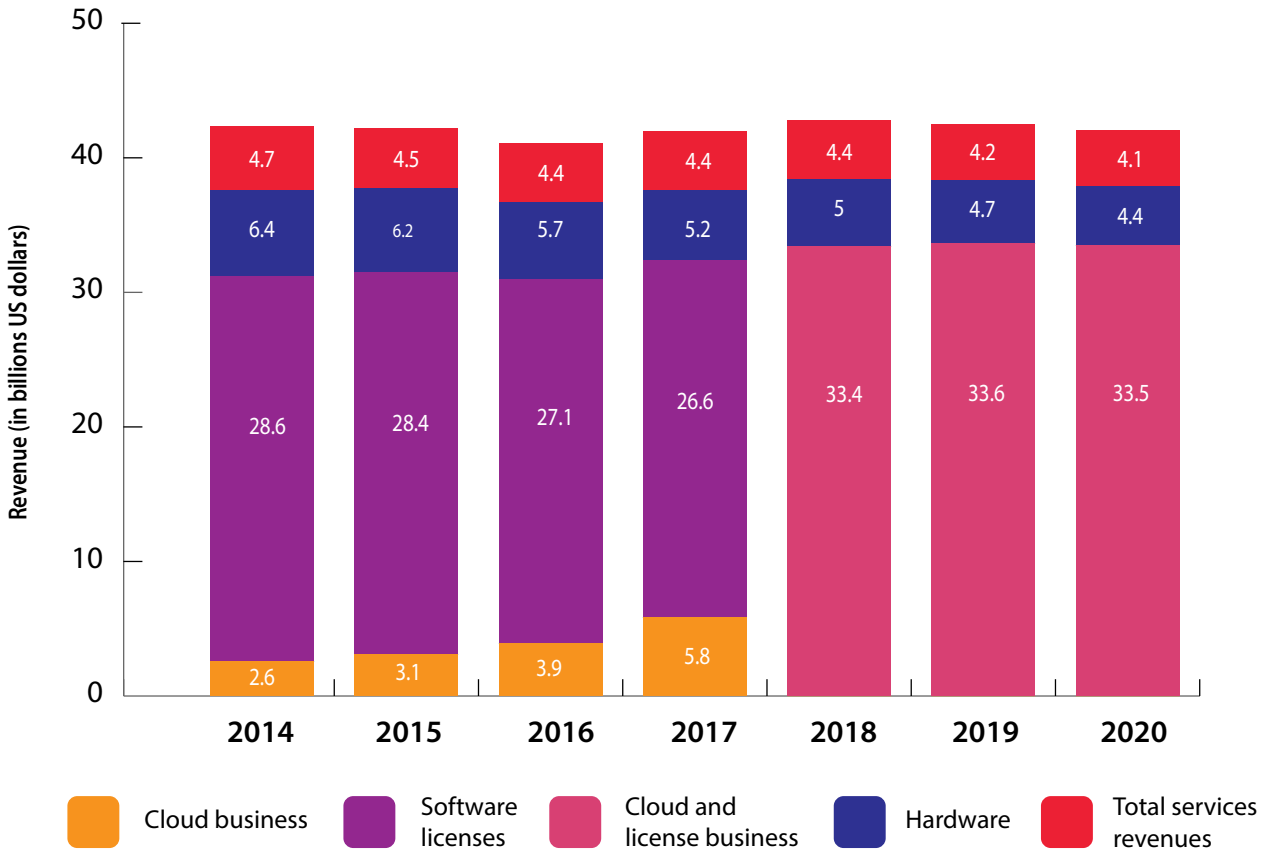
Source: Amazon.com Annual Report 2019[67]

65. Oracle also managed to strengthen its cloud services offering over the past years, as illustrated in Figure 4. However, the publicly available data does not distinguish between cloud-related licenses for Oracle databases, and IaaS or PaaS services.

66 FourWeekMBA, *Why Is AWS so Important for Amazon Future Business Growth*. Available at https://fourweekmba.com/aws-amazon-business-growth/, (accessed on June 28th, 2021).

67 Statista (2020), *Global net revenue of Amazon from 2014 to 2019, by product group.* Available at: https://www.statista.com/statistics/672747/amazons-consolidated-net-revenue-by-segment/, (page accessed on June 26th, 2021).

Figure 4: Oracle's revenue by segment (2014-2020*, in billion U.S. dollars)



Source: Oracle Corporation Form 10K 2020 68. Notes: *Fiscal years.

66. In the remainder of this section we provide evidence that Microsoft and Oracle have been engaging in several anti-competitive practices, leveraging their market power in adjacent product segments to exclude other cloud computing infrastructure providers (naked and integrated).

3.1 EVIDENCE OF ONGOING ANTI-COMPETITIVE BEHAVIOURS UNDERTAKEN BY SOFTWARE PROVIDERS IN THE CLOUD COMPUTING INFRASTRUCTURE SECTOR

67. Our research has shown that the position of certain large cloud infrastructure providers in the adjacent markets, notably Microsoft and Oracle, has enabled them to engage in potentially anti-competitive strategies to exclude other cloud infrastructure providers from the market. Moreover, these strategies have been an engine of growth for those integrated cloud service providers. Indeed, the links between Microsoft's rapid growth and possible anti-competitive practices are widely discussed in the press. Raj Bala, Gartner's main cloud-infrastructure expert, declared that *"Microsoft is taking its arsenal of Windows Server, a massive installed*

68 Statista (2020). *Oracle's revenue by business segment from FY2008 to FY2020.* Available at: https://www.statista.com/statistics/269728/oracles-revenue-by-business-segment-since-2008/, (page accessed on June 26th, 2021).

software base, and using it punitively against its competitors".[69] 'The Economist' also points out that Microsoft already leveraged its dominance of some markets to impose Internet Explorer, and exclude competitors like Netscape from the market and concludes: *"How closely is Microsoft flirting with the kind of behaviour that got it in trouble in the late 1990s?"*.[70]

68. In this section, we highlight a number of behaviours currently being undertaken by Microsoft and Oracle that have the potential to be anti-competitive and to harm competition in the cloud infrastructure services market. In particular, we focus on a particular example of a potentially anti-competitive behaviour: Microsoft's "Bring Your Own Licence" (BYOL) policy changes. Microsoft indeed requires customers who choose a third-party cloud infrastructure provider to repurchase licences they already held on-premises, making its own cloud infrastructure offer, which did not require a repurchase, more appealing for customers.

3.1.1 Increase in licensing costs

69. The preliminary desk research and document review shed light on some evidence regarding Microsoft's alleged practices in the segment for public cloud services. Recent communications between the Danish Cloud Community and the European Commission[71] point at a practice affecting the Danish market as early as 2018. According to the communication, Microsoft increased prices on the Office and Server software (on which it enjoys a dominant position). These software are used by the majority of hosting and cloud infrastructure companies and are a necessary requirement for most cloud infrastructure solutions.

70. Microsoft did not, however, change the prices of similar software when used within its clouds (Azure and Windows 365, which directly compete with local cloud operators). This implied *de facto* that the price of Office products is higher when combined with a third-party cloud infrastructure service, and thus makes the purchase of a bundled good more likely.

71. This practice can be summarised as follows:

- Microsoft initially delivered software services under SPLA (Service Providers Licence Agreements) to its MSP (Managed Service Providers/Hosting companies) partners via lease agreements; service providers and ISV (Independent Software Vendors) licence Microsoft products on a monthly basis for a three-year term. The service provider, rather than the end-user, is thus the licensee. However, Microsoft reserves the right to decrease SPLA prices at any time, or to increase them annually.[72]
- When using licences within Azure and Office 365, providers adhere as CSP (Cloud Service Provider) and become the end customer's single point of contact (tier 1 option) or become distributors or resellers (tier 2 option). Roles can be

69 The Economist (2020), *Briefing Microsoft - after the reboot.* Available at www.economist.com/briefing/2020/10/22/how-satya-nadella-turned-microsoft-around, (accessed on June 26th, 2021).

70 *Ibidem.*

71 Danish Cloud Community (2019). *Letter addressed to Mr. Friedrich Wenzel Bulst of the European Commission / Cabinet of Vestager.* Signed Jens E. Thorndahl and Søren Frandsen 6th February, 2019.

72 See for example, Microsoft document (2019). *Updated licensing terms for dedicated host services FAQ.* Available as download here, (accessed on June 26th, 2021).

product-specific. A partner can be an Azure CSP indirect reseller for Azure (to reduce investments to Azure billing and support) and an Azure CSP direct partner at the same time (for Office 365, Dynamics 365, and other licence-based products).[73] In the direct case, Microsoft bills the Azure CSP direct partner monthly, based on the usage of all Azure CSP customers and all Azure CSP subscriptions. In the Azure CSP indirect model, Microsoft bills Azure CSP providers in a similar way, and Azure CSP indirect providers set the billing rules for their Azure CSP indirect resellers.

- According to the communication, whilst prices for CSP agreements remained unchanged, SPLA prices have increased by 10-15% in January 2018 and again in January 2019. This puts providers into the difficult situation between passing on the SPLA price increase to customers or becoming CSPs and migrating to Azure and Office 365. This implies that third-party providers might now find it more difficult to offer Microsoft licensed product with their own IaaS infrastructure, as it is relatively more expensive than with Azure. We may note that this practice could be considered a self- preferencing strategy.

72. A similar licensing policy change was enacted by Microsoft in October 2019, affecting in particular the group of "Listed Providers"[74] (Alibaba, Amazon including VMware Cloud on AWS, and Google) that offered dedicated cloud infrastructure services.

73. Under the outsourcing standard term "Bring Your Own License" (BYOL), software customers can use the software on their on-premises hardware and have also the option to freely deploy the same software on hardware leased from and managed by 'traditional outsourcers'.

74. In practice, this standard allowed Microsoft software customers to migrate their activities to the cloud without having to re-purchase a Microsoft licence. This came to a halt in October 2019, when Microsoft launched a new infrastructure service, Azure Dedicated Host, and imposed a requirement for Licence Mobility for 'Listed Providers', thus requiring the repurchase of the same Microsoft software licence for cloud infrastructure other than Azure.[75] Microsoft would have used its dominance in productivity software and operating systems to draw a substantial wedge between its own integrated cloud activities and rival cloud infrastructure providers as the customers of cloud infrastructure services rely extensively on the Microsoft software. Indeed, the practice made competitors' offers far less convenient, as they required a licence repurchase for a product that is necessary for many customers. This is a clear example of how, by leveraging its power on a non-cloud product, Microsoft could distort competition in the cloud infrastructure services market segment.

75. To provide a practical example of the implications of this policy, the diagram below shows the current licensing options for users of Google Cloud who require usage of

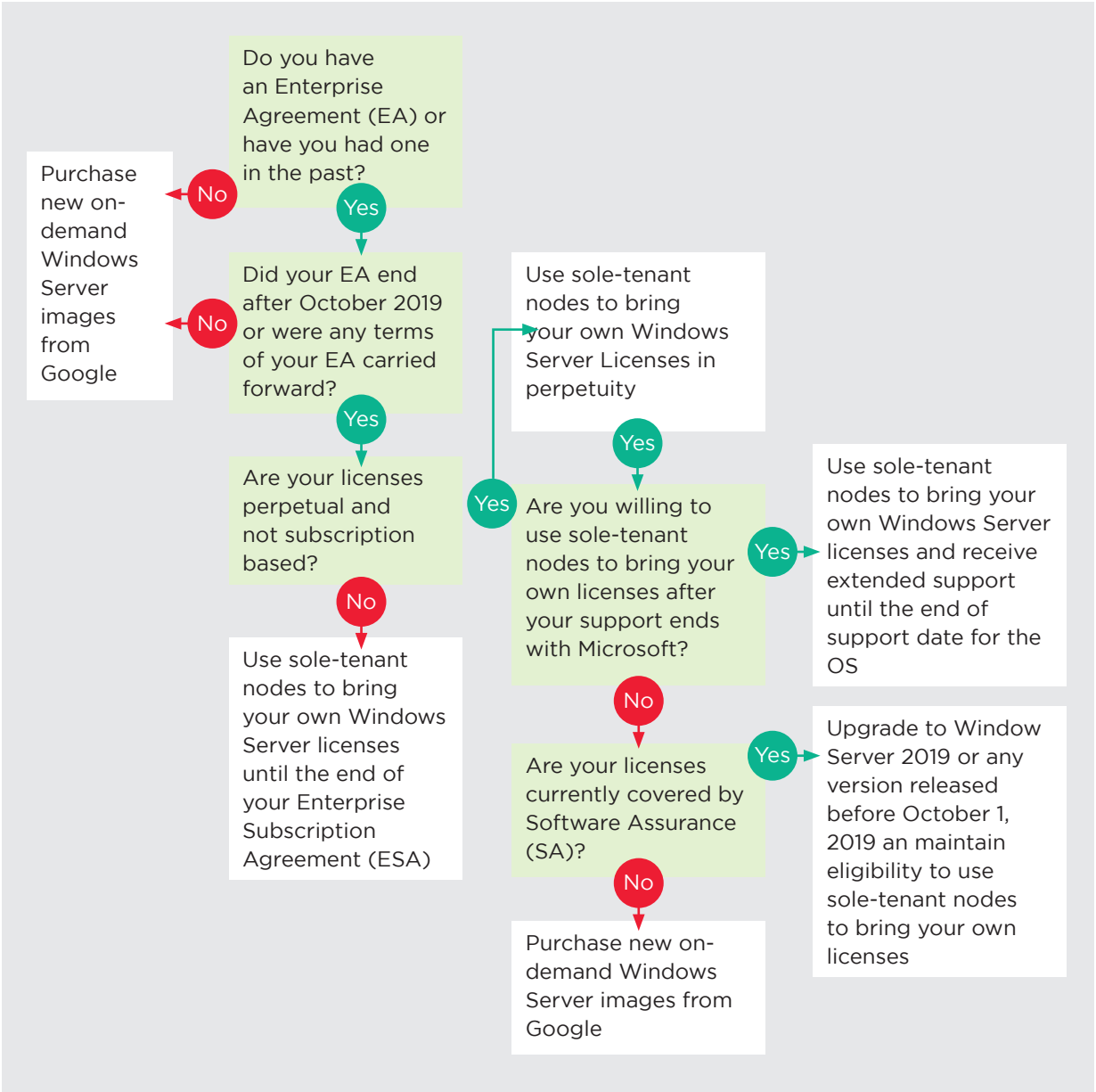
73 Qualiero (2020). Azure CSP Overview. Available at https://www.qualiero.com/en/download-handler.html?dl=17736, (page accessed on June 26th, 2021).

74 Listed Providers is a term coined by Microsoft in October 2019 to define specific dedicated hosted cloud services providers.

75 See for example, Microsoft document (2019). *Updated licensing terms for dedicated host services FAQ*. Available at download.microsoft.com/download/3/0/8/3082C2FA-16B5-4025-B003-DB9EFEDF91D2/FAQ%20for%20 customers%20 Microsoft%20outsourcing%20rights%20updates.pdf, (page accessed on June 26th, 2021).

Windows Server. The flow diagram below highlights that for enterprise agreements effective after October 2019, the user must purchase on-demand Windows Server usage from Google, implying an additional cost. For those effective before October 2019 or carried forward, BYOL usage of Windows Server (or Windows SQL Server) is bound to rapidly expire, as it critically hinges on either: i) the duration of the OS, ii) purchasing Software Assurance coverage, iii) the duration of the ESA, or, iv) purchase of new on-demand versions of the products (from Google, in the case at hand).

Figure 5 : Google's display of the BYOL policy changes



Source: Google Cloud help page[76]

76. Similarly, AWS explains that users currently have two options: buying licence-included products from AWS directly - in which case AWS manages the compliance - or bringing their own. BYOL only holds *as long as the licences are purchased prior*

76 Google Cloud (2021). Available at https://cloud.google.com/compute/docs/instances/windows/ms-licensing#bring_your_own_ licenses_ to_sole-tenant_nodes, (page accessed on June 26th, 2021).

to October 1, 2019 or added as a true-up under an active Enterprise Enrolment that was effective prior to October 1, 2019, or, in other cases, by purchasing Licence mobility via Software Assurance.

77. According to Microsoft, this change was required *"to clarify the distinction between on-premises/traditional outsourcing and cloud services and create more consistent licensing terms across multitenant and dedicated hosted cloud services"*. This change concerned *"all on-premises software available through Microsoft volume licensing as of October 1, 2019"*.

78. The seamless use of Microsoft software on the cloud is portrayed as a centrepiece element to boosting Azure cloud users. Microsoft defines Azure Hybrid Benefit as *"a licensing benefit that lets you bring your on-premises Windows Server and SQL Server licences with active Software Assurance or Linux subscriptions to Azure and helps to significantly reduce the costs of running your workloads in the cloud"* [77].

79. Microsoft does not publicly provide any technical explanation to justify this policy, but rather, emphasises the significant savings when compared to AWS' proposition: *"AWS is 5 times more expensive than Azure for Windows Server and SQL Server. Why run them anywhere else?* [...] *Other cloud service providers may claim to have similar savings to the Azure Hybrid Benefit, but* ***you'll need to repurchase your Windows Server licence on those clouds.*** *And only Azure offers free extended security updates for Windows Server 2008 and 2008 R2."*[78]

80. Microsoft has a substantial track record of similar strategies to increase its user base. Industry analysts note how Microsoft is leveraging its Office365 dominance to boost its presence in the collaborative software segment (Teams). In their view, the remarkably sudden growth of Microsoft Teams is likely influenced by the fact that it is available at no additional cost to Office 365 users.[79] The recent competition complaint brought by Slack against Microsoft[80] confirms the widespread concerns of competitors about Microsoft's behaviour.

81. Other software providers showed a similar behaviour: for instance, Oracle's licensing restrictions lead to a price multiple of 10 times when using Oracle software on a third-party cloud infrastructure (IaaS) when compared to running it on Oracle IaaS. Additionally, Oracle has employed technical and billing requirements related to licensing *per* CPU: if Oracle software is used on Oracle IaaS then companies are only required to pay for the number of *actual* CPUs used while if it used on third-party IaaS equipment, the company is required to pay for a licence for each CPU that *could* be used to run the software, whether or not it actually is. This behaviour strongly limits scalability, as it reduces the flexibility in computing power that is expected from cloud computing services and increases costs to users of third party IaaS.

77 See, for example, Microsoft Azure webpage: https://azure.microsoft.com/en-us/pricing/hybrid-benefit/, (page accessed on June 26th, 2021).

78 See, for example, Microsoft Azure webpage https://azure.microsoft.com/en-us/overview/azure-vs-aws/cost-savings/, (page accessed on June 26th, 2021).

79 The Startup (2020), *Why Microsoft Teams Has Been Overtaking Slack in 2020*. Available at: https://medium.com/swlh/why- microsoft-teams-has-been-overtaking-slack-in-2020-734f7bf6f824, (page accessed on June 26th, 2021).

80 See, for example, Slack public blogsite. https://slack.com/intl/it-it/blog/news/slack-files-eu-competition-complaint-against-microsoft, (page accessed on June 26th, 2021).

82. In conclusion, the publicly available evidence points to how all Microsoft's licensed products are more expensive when used on third-party cloud infrastructure providers, without any obvious reason driving differences in the cost of supply for Microsoft. The in-depth interviews also confirmed this observation and highlighted that in practice, when a customer opts for a cloud infrastructure provider other than Microsoft, this implies the requirement to pay for individual Office licences on each computing instance.

83. As Microsoft is dominant on some of the software product segments at-hand, and its products might be a requirement for a successful transition to the cloud, this pricing policy provides a great advantage to Azure and Microsoft's cloud products, harming its competitors. A similar conclusion can be reached for Oracle, albeit limited to database management.

3.1.2 Other practices as highlighted by cloud services providers

84. Besides the increase of licensed product prices and the attempt to push customers to purchase bundles, some further possibly anti-competitive behaviours can be identified. While the research on these is just preliminary, this section sheds light on a series of potential practices that might be anti-competitive, as provided by a survey of cloud infrastructure providers.

- **Bundling – tenders:** Microsoft exploits bundling practices to win tenders by offering Azure for free in a bundle with the upcoming renewal of Microsoft licences that the client already has. Some providers claim that they have received information from potential clients that while they were best qualified based on technical and financial criteria for the tender, they ultimately lost the tender to Microsoft due to such practices. In particular, it appears that this kind of offers are made only after Microsoft loses a tender and exploiting information they might hold thanks to their other services (e.g. the exact size and needs of a firm). Moreover, Microsoft offers free Azure credits to customers holding already an Office or a on premise SQL Server licence.
- **Information sharing:** Microsoft attempts to leverage per-customer software billing to extract information on users of Cloud Service Provider (CSP) partners. In particular, Microsoft demands customer information from its CSPs, allegedly in order to directly bill them for the software used, but instead uses such information to try to convince the customers to switch cloud infrastructure services providers. In our interviews, some cloud providers indicated that they have been able to resist such demands from Microsoft thus far, however it has been heard that other smaller providers may have acquiesced to Microsoft.[81]
- **Foreclosure:** Microsoft leverages on its dominant position in desktop Operating Systems to prevent entry of other players in product segments where it has not yet developed its own offering, for example by denying interoperability. Years ago, non-integrated providers wanted to develop Virtual Desktop Infrastructure (VDI) services but could not do so because Microsoft did not allow the use of its technologies for remote connection. Microsoft has since started developing its own VDI that it offers to clients. Microsoft, which developed its cloud solutions

81 European Commission (2020). *Antitrust: Commission sends Statement of Objections to Amazon for the use of non-public independent seller data and opens second investigation into its e-commerce business practices.* Available at https://ec.europa.eu/commission/presscorner/detail/en/ IP_20_2077, (accessed June 26th, 2021).

later than other providers, would have delayed its competitors by not licensing its software.

- **Reduced compatibility to raise rival's costs:** Microsoft is already tying some of the functionalities of its products to other products they offer. For instance, Office 365 Word, the SaaS version of the popular writing software, does not enable auto-save on local PC or other storage providers other than One Drive.[82] This clearly creates a barrier to the use of competitor services. Similarly, Microsoft Teams also links its file sharing to One Drive, creating a further incentive to use this service instead of competitors.[83]
- **Delayed patches to raise rivals' costs:** by controlling some necessary components of the cloud products, Microsoft could use patches to worsen the quality of competitors' cloud infrastructure services. Indeed, by releasing many patches and by providing their content to their competitors later than to their own developers, Microsoft could determine less stability in the quality of the service, providing further access. Indeed, at any patch release, an important engineering work in needed to be sure that the whole system works smoothly with the most up to date versions of Microsoft products.
- **Reduced after sales support to raise rivals' costs:** Microsoft would have stopped to provide technical support to old on-premise SQL Service licences that were moved to third-party cloud infrastructure, while providing this service to those who migrated the same licences to Azure.

3.2 SURVEY EVIDENCE OF ONGOING ANTI-COMPETITIVE BEHAVIOUR UNDERTAKEN BY SOFTWARE PROVIDERS IN THE CLOUD COMPUTING INFRASTRUCTURE SECTOR

85. As part of this study, we undertook a series of interviews with large cloud users, all of whom are heavily reliant on cloud services in their business activities and/or are in the process of migrating onto the cloud. The goal was to collect first-hand testimonies on the users' experience dealing with integrated cloud service providers, and to gather evidence of the different ways in which providers leverage their market power to impose unfair conditions on customers and customers alike.

86. Across our meetings, instances of exploitative abuse represented the bulk of the participants' complaints. Nevertheless, we may note that allegations of anti-competitive behaviour remained a recurring, and important, theme. In what follows, Section 3.2.1 begins with an overview of the alleged unfair/abusive practices, whilst Section 3.2.2 digs deeper into specific instances of alleged anti-competitive behaviour of some software providers, and discusses these in relation to our work.

3.2.1 Cases of unfair & abusive practices

87. Regarding unfair and abusive practices of software providers, the majority of the respondents' complaints centred on providers' unilateral ability to set terms and conditions, which allows them to extract rent and engage in arbitrary, after-the-fact changes to agreed conditions.

82 See, for example, Microsoft Community Page: https://answers.microsoft.com/en-us/msoffice/forum/msoffice_word-%20msoffice_custom- mso_2016/how-to-autosave-local-to-pc-instead-of-to-onedrive/8631fa3c-3af4-49f7-8f83-b80c3f3389e8, (accessed on June 26th, 2021).

83 See, for example, Microsoft Support page: https://docs.microsoft.com/en-us/microsoftteams/sharing-files-in-teams, (accessed June 26th, 2021).

88. Whilst the allegations were diverse and numerous, three key strands of practices emerged:

i. **Abusive licensing practices:** Providers resort to opaque and ever-changing software licensing terms intended to confound users, restrict switching, and extract rent ex-post. These are often coupled with "aggressive auditing" practices designed to exact penalties for non-compliance.

ii. **Ex-post changes to commercial conditions:** Respondents report that once users are "locked-in" into their contract, the relationship with software providers often rapidly deteriorates. Providers are noted to implement price hikes on customers on renewed contract cycles ("drip prices"), as well as exacting surcharges through changes to licensing and pricing models.

iii. **Product obsolescence / incompatibility:** Software providers leverage obsolescence as a means to force customers into purchasing new product cycles, despite the initial expectations of long product cycles upon the purchasing decision.

89. Regarding abusive licensing practices, metric partitioning policies were a recurrent concern. In particular, on two separate instances, respondents highlighted Oracle's nebulous but aggressive policies on CPU usage. They recount their attempts to deploy VMWare, a virtualisation software designed to streamline concurrent computing processes. However, despite the fact that Oracle's proprietary software would be limited to a defined selection of virtual environments, the provider was noted to have stipulated an ever-growing pyramid of licensing surcharges, ones that began from the CPU core level, then to the cluster/node, before eventually being extended to the central management (VMCenter) level.

90. The opacity and complexity of the licensing specificities are such that most respondents characterise them as deliberate and intentional measures to increase software providers' bargaining power. For example, one respondent notes that whilst transitioning to the cloud may represent cost savings in the short term, this is not necessarily the case over the long run. The decrease in material investments is often counter-balanced by an increase in human investments, indispensable to ensuring compliance with the myriad of licensing technicalities and to "effectively deal with the constraints".

91. Practices relating to ex-post changes to commercial conditions - especially those of drip pricing - were another common concern. Under this, some integrated cloud providers, with a strong position in software, would display initially low licensing prices in the contract negotiation phases, but add to prices after the sale. This is particularly problematic given significant switching costs, and in some cases imposed minimum contract requirements.

92. For example, one respondent noted that Microsoft had obliged the company to undertake a contract of at least three years, with a corresponding refusal to supply if the user would not agree. Similarly, another participant highlights that whilst initial negotiations are typically competitive, prices are almost always increased upon contract renewal, with price hikes in the range of 30-40% (€10M's).

93. On the question of imposed incompatibility, Microsoft's obsolescence tactics provides an instructive case. The respondent in question notes that the software provider would engineer its newer products and functionalities in such a way, as to be poorly compatible with the older versions of adjacent products. As such, users of prior versions (say, Windows 7) would see themselves forced to purchase the renewed versions of the product, in order to be able to continue benefiting from tools that had initially formed part of the integrated package.

94. Finally, we may note a fourth recurrent complaint: that of significant switching and migration costs. However, the feedback here was mixed. Whilst some described the transition to competing ecosystems as not only feasible, but "desirable and economically viable", others mentioned costs in the order of the tens of millions. A nuance put forward by a participant may be instructive: he notes that for "standardised" services (e.g. website hosting, transferable functionalities), switching is indeed possible. However, this may be much less the case for specialised or "niche" products, where the restrictions become much more apparent.

3.2.2 Practical examples of anti-competitive behaviour

95. The following section shifts the discussion onto the examples of potentially anti-competitive behaviour alleged by survey participants, which serve to corroborate our theoretical work detailed above. In general terms, the anti-competitive practices highlighted fall into three key areas: i.) Mixed bundling practices, ii.) Limits to interoperability, iii.) Exclusionary licensing practices. The last, in particular, was broad in its scope, covering both licensing restrictions intended to raise rivals' costs and the prevention of the interfacing of third-party applications with the incumbent's ecosystem.

3.2.2.1 Bundling

96. The survey provided concrete evidence of software providers leveraging their position in the adjacent software market of cloud infrastructure services to gain more customers in the cloud infrastructure services segments. One respondent, in particular, was able to confirm Microsoft's bundling practices, which includes both mixed bundling and tied products.

97. On mixed bundling, the respondent gives the example of Microsoft's Office 365 whose licences grants access SharePoint Online. In the case where the user decides to "unwind" the bundle (i.e. purchase the individual products separately), this could imply a price increase of up to 70%.

98. On the impact of bundling on the competitivity of other providers' services, he notes that the combination of, for instance, Office 365 with Amazon Web Services, does not necessarily translate into an increase in price for the "outside" bundle. Rather, the integrated offer of Office *with* Azure is structured in such way that a lower "in-house" price can be expected, and thus users are highly incentivised to prefer Microsoft's offering and to remain captive.

99. Other respondents note that bundling is also achieved by the refusal to detail the precise price structure of SaaS offerings. They highlight that integrated providers actively strive to maintain opacity in pricing, as well as favouring

bilateral agreements on pricing and conditions - often signed with a confidentiality agreement. This, as a result, makes it difficult for cloud users to compare offers and allows cloud providers to extract rent through differential pricing in a highly "personalised" industry.

100. On the question of tied products, a respondent gives the example of Teams' integration into the Office 365 suite, whereby the fully cloud-based collaboration tool is automatically included in all subscriptions to Microsoft's SaaS offering. This, he notes, pushes users to favour Teams as their main collaboration tool – to the detriment of competing products - since there is "little incentive in repaying for something that does 90% of the job".

101. As an addendum, the respondent also notes that software providers have begun to take this logic one step further, by selling licences where the maintenance policy is no longer separable from the product itself. This is achieved in two ways. Some, such as Oracle, obliges customers to pay the maintenance fees in addition to the core product offering, whereas others have begun to adopt a more nuanced approach by ceasing to make the distinction and selling the bundle like any standard subscription-based licence.

3.2.2.2 Limits to interoperability

102. Our conversations reveal three forms under which software providers create limits to interoperability. The first relate to specificities of a technical nature, whereby software providers may employ operating specificities or proprietary language to reduce the ease of interaction (and eventually migration) between systems.

103. The second form pertains to switching costs, which may be significant both in monetary and time-duration terms. Indeed, the European Commission details in the impact assessment of the Digital Markets Act that switching costs are already considerable when a customer uses IaaS cloud services, but they are even higher when using PaaS and SaaS services.[84] Our conversations confirmed that migration between systems is an inherently cumbersome and expensive process, costing in the millions and taking anywhere between months to several years.

104. But the impact of high switching costs goes even further to generate complete lock-in effects: as a respondent points out, given lengthy migration times - and the desire to amortise the remainder of contractual costs - users are often incentivised to accept unfavourable renegotiated terms rather than abandoning the ecosystem altogether.

105. A third form of limits to interoperability concerns the way software providers leverage compatibility concerns as a means to keep users on the native platform. This compatibility is highly valued by respondents who often mention speed and seamless utilisation, or lack thereof, as an important dimension. Concretely, this often expresses itself in one of two ways:

i. Compatibility as *Optimisation:* in-house functionalities are often engineered in such a way as to work best within the native platform, and to form "natural

84 Publications office of the EU (2020). *European Commission Digital Markets Act - Impact assessment support study - Annexes.* Available at: www.op.europa.eu/en/publication-detail/-/publication/2a69fd2a-3e8a-11eb-b27b-01aa75ed71a1/language-en, (accessed May 20th, 2021).

pathways" towards other product suites.

ii. Compatibility as *Guarantees:* Users are encouraged to resort to "approved partners" when integrating non-native functionalities into the local ecosystem, with any other recourse spelling the end of product warranties. This control of the certification chain allows dominant providers to artificially limit compatibility with certain players and ultimately reduces user choice.

106. On the notion of optimisation as a limit to interoperability, a respondent gives the example of Microsoft. As a large user of SharePoint and Office365, this requires a heavy reliance on certain core functionalities that links the two suites. However, he notes that if it does not use Azure to support these functionalities (i.e. the native infrastructure interface for Microsoft products), the process is poorly optimised and becomes much less enticing for the user. For example, a web development project through SharePoint may take minutes on Azure, but several days on AWS. Furthermore, Azure presents an additional advantage in that error messages are standardised vis-à-vis SharePoint, which allows the company to track more efficiently progress and eliminates the need for external error-recognition programs.

107. On the "natural pathways", the respondent further notes that the synergies between Azure-native products are such that users of product types in one part of Microsoft's ecosystem are highly incentivised to use Microsoft's other suites to deploy workflows. In an "end-to-end" approach, he gives the example of using Office 365, which leads naturally to Teams as a collaboration tool and OneDrive/ SharePoint as a cloud-based storage solution. The optimisation of SharePoint with other development tools (Flow, .NET) on Azure in turn means that workflows are streamlined, reducing the need for interfacing applications and safeguards against data loss.

108. Questioned on whether this may be the result of some underlying technical constraint, as opposed to an "intentional degradation" of interoperability, respondents suggest that the question requires nuance. It is noted that from Microsoft's point of view, the company would claim that they are offering "standard compatibility" on the non-native process, and that they have all but optimised processes within their native environment. As such, limits to interoperability, coupled with lack of transparency on costs, may indeed come at the guise of creating an "added-value" for users, specifically the ones that adhere to their in-house offerings.

3.2.2.3 Exclusionary licensing practices

109. A final anti-competitive behaviour that stood out across the interviews concerned the use of exclusionary licensing practices. Given the power of integrated providers to set terms and conditions – often in a unilateral manner - this gives room for incumbents to impose licensing models intended to exclude competition, in particular, to raise rivals' costs.

110. A first instance of this pertained to Microsoft's alleged retaliatory licensing policies, which may be framed as part of a wider change to the provider's Bring Your Own

Licence (BYOL) policy explained above. Under the prior terms, Microsoft had given on-premises customers the option to freely deploy Microsoft software on hardware leased from and managed by traditional hardware outsourcers. However, this came to an abrupt halt in October 2019, when Microsoft launched a new infrastructure service, Azure Dedicated Host, and with it imposed licence renewals outside of the Azure ecosystem.

111. In one instance, a respondent recounts that in fielding offers for its cloud infrastructure servicing, the company had received competitive offers from Amazon, Microsoft and Google. However, following the decision to opt for Amazon Web Services, Microsoft was noted to have imposed an "after-the-fact" change to its software licensing policy, which saw the company obliged to pay for individual Office licences on each computing instance. This, notably, resulted in tens of millions of additional costs per annum.

112. A second instance of exclusionary licensing practices pertains to the prevention of third-party interfacing. By exacting software licensing surcharges on competitors' cloud products, incumbent software providers are effectively able to raise rivals' costs of cloud services providers, who see themselves unduly penalised for reasons beyond competitive merit.

113. An example of such is SAP's widely criticised Indirect Access, whereby customers interfacing into the SAP ecosystem through third party applications would see its activities alerted to the system, before being channelled to the SAP database. This effectively creates an active log of "indirect" usages of SAP software, rendering the user liable to licensing surcharges under the provider's terms of use.

114. Another example brought forward pertains to Oracle's maintenance policy. A respondent notes the case of Spinnaker, which offers technical support at a discount from official support. However, the user notes deliberate efforts by Oracle to complicate the migration of workloads to the third-party provider, notably by stipulating restrictive download limits (500 documents max) and time-limits (archived materials must be deployed within 90 days).

115. Both cases provide evidence of how cloud providers can often leverage their dominant tightly integrated ecosystem to prevent cloud users from interfacing / inter-operating into their core platform – to the detriment of choice and the contestability of these ancillary services.

Table 3: Summary of unfair or anti-competitive practices highlighted across our meetings

	Practice 1	Practice 2	Practice 3	Practice 4
Exclusionary Abuse				
Limits to Interoperability	Proprietary Language	Technical specificities of operating system	Optimisation of native ecosystem (Microsoft)	End to product guarantees upon recourse to third-parties (Workday, Salesforce)
Mixed Bundling	Bundling of Office 365 with Azure (Microsoft)	Product Tying: Teams integration with Office 365 (Microsoft)	Maintaining opacity in SaaS price structuring	Bundling maintenance policy into subscription licence (Oracle)
Exclusionary licensing	Raising Rivals' Costs (Microsoft, SAP)	Retaliatory licensing practices (Microsoft BYOL)	Preventing 3rd party interfacing into native platform (SAP Indirect Access)	Exclusion of third party support (Oracle Maintenance)
Others	"Proprietary" data stipulations, leading to migration surcharges (Oracle)	Switching and Migration costs (Mixed feedback)	Aggressive acquisitions of competitors (Salesforce)	-
Exploitative Abuse				
Abusive licensing practices	CPU Metric Partitioning (Oracle)	Ex-post changes to licensing conditions	Aggressive auditing of non-compliance to licensing changes (Oracle, Microsoft)	-
Exploitative pricing practices	Ex-post changes to commercial conditions	"Drip Pricing" (Microsoft, Oracle)	"Only way up" pricing on contract renewals (Microsoft)	Minimum contract requirements, with refusal to supply (Microsoft)
Obsolescence / Product Incompatibility	Early termination of product cycles	Poor compatibility of new functionalities with old versions (Microsoft)	-	-

4

Conclusion

4 CONCLUSION

116. Cloud computing services are of paramount importance as the digitalisation of the economy increases. With the recent pandemic further propelling the transition from on- premise services to cloud services, anti-competitive practices could sow the seeds of a future oligopoly, which would harm innovation and competition in this critical marketspace.

117. Given the strong links between software and cloud infrastructures, anti-competitive practices by legacy software providers can distort competition in the cloud infrastructure services sector and hamper the future of the cloud. These practices could unfairly consolidate the power of a handful of firms vis-à-vis the whole economy and prevent the creation of the "European Cloud" that the Commission's Horizon 2020 identifies as one of the prerogatives of its action.[85] Observers already noted that Microsoft stock price is already discounting its future success in cloud markets.[86]

118. This report provides preliminary but informative elements for competition authorities to further investigate those practices by software providers, in particular, Microsoft and Oracle, in order to assess the existence of exclusionary strategies and anti-competitive effects in the cloud infrastructure services market segment.

119. In parallel to this ex-post assessment under competition rules, the Digital Markets Act offers an ex-ante approach to tackle without delay the practices by some incumbent and very large software providers also offering cloud infrastructure services, so as to prevent abusive strategies that may irremediably tilt the cloud infrastructure service market.

120. The presence of lock-in effects, high switching costs, barriers to entry, economies of scale and potential network effects in a fast-growing cloud services market make action particularly urgent, as it will be difficult for other cloud services providers to compete on the merits and for the innovation in this sector to continue to grow for the benefits of the cloud users. Customers of cloud infrastructures services should be guaranteed to rely on the Digital Markets Act to stop abusive practices of the very large incumbent software providers.

85 European Commission (2020). *The European Cloud Initiative.* Available at https://ec.europa.eu/digital-single-market/en/european-cloud-initiative, (accessed on June 26th , 2021).

86 he Economist (2020), *Briefing Microsoft - after the reboot.* Available at www.economist.com/briefing/2020/10/22/how-satya-nadella-turned-microsoft-around, (accessed on June 26th, 2021).

5

Annex

5 THE EVOLUTION OF CLOUD COMPUTING SERVICES

121. This Annex provides useful background information on the overall size and evolution of the cloud computing market industry before providing more detail on the market size, cloud spending and competitor shares revenues for :

- The IaaS market, and
- The SaaS market.

5.1 *THE SIZE AND EVOLUTION OF THE OVERALL CLOUD COMPUTING MARKETSPACE*

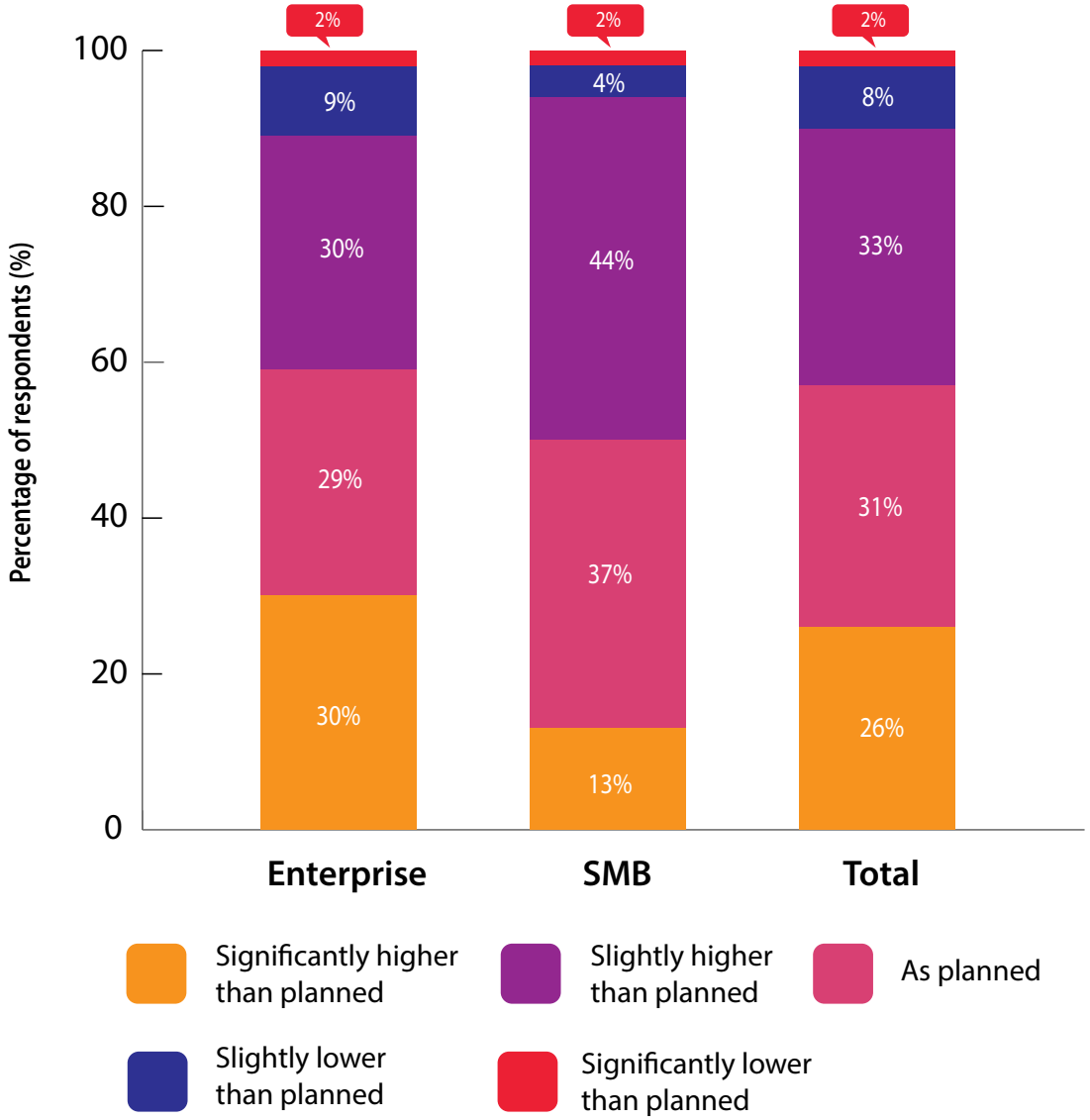
122. The cloud computing market developed at first to provide Infrastructure as a service (IaaS), a way for customers to outsource the operation and maintenance of infrastructure-like servers and network storage. The market later developed further into PaaS and SaaS.[87] As of 2019, the European cloud computing market exceeded 28.1 billion Euros, up 16.3% from 2018.[88] 24 Whilst estimates of its size vary, SaaS remains the most significant segment accounting for 50% to 65% of the overall market.

123. An unprecedented number of customers have been migrating to cloud services as a result of the COVID-19 pandemic. A Flexera survey from 2020 showed (as illustrated in Figure 6 that more than half of the respondents transitioned to the cloud faster than they had originally planned at the beginning of 2020, before the pandemic. Additionally, the study showed that more than 50% of firm workloads and data are expected to be on the cloud by 2021 worldwide.

87 Publications office of the EU (2020). *European Commission Digital Markets Act - Impact assessment support study - Annexes.* Available at https://op.europa.eu/en/publication-detail/-/publication/2a69fd2a-3e8a-11eb-b27b-01aa75ed71a1/language-en, (accessed on June 26th, 2021).

88 NTT Data (2020), *Cloud transformation roadmap: Cloud strategy trends in Europe.* Available at https://de.nttdata.com/files/2020- en-wp-cloud-transformation-roadmap.pdf, (accessed on June 26th, 2021).

Figure 6: Change from planned cloud usage due to COVID-19 (% of respondents)



Source: Flexera 2020 State of the Cloud Report[89]

89 Flexera (2020), *Cloud Computing Trends: 2020 State of the Cloud Report.* Available at: https://www.flexera.com/blog/industry-trends/trend-of-cloud-computing-2020/, (accessed on June 26th, 2021).

124. While the pandemic undoubtedly served as a catalyst, the transition to the cloud has been fast growing for many years. For instance, public cloud computing services (including infrastructure, platforms, software, security and advertisement services) worldwide are forecasted to exceed $364 billion in revenue by 2022, up from $243 billion in 2019 (an increase of 50 percent in only three years).[90] In Europe, the market is forecast to reach $140 billion by 2028, growing at an estimated CAGR of 15% between 2021 and 2028.[91]

125. The degree of penetration, however, varies substantially across countries and across enterprise sizes. Large firms accounted for around 65% of the European market in 2020.[92] Small and medium enterprises ("SME") having particularly low uptake: in France, for example, only 17% of firms with fewer than 10 employees rely on cloud services, while the equivalent figure in Finland is 57%.[93]

5.2 IAAS MARKET SIZE AND SHARES

126. Despite its rapid growth, cloud computing, and in particular IaaS services, are still in their infancy. Indeed, one of the pioneers in this sector, Amazon, launched its first cloud computing offer in 2006, well before other big tech firms like Google or Microsoft.

127. Figure 7 shows a double-digit annual actual and forecasted growth for the public cloud IaaS services, where revenue is projected to reach $65 billion in 2020. This figure also highlights that IaaS services are expected to grow rapidly over the next five years, with revenues expected to grow by 21% year on year in 2025.

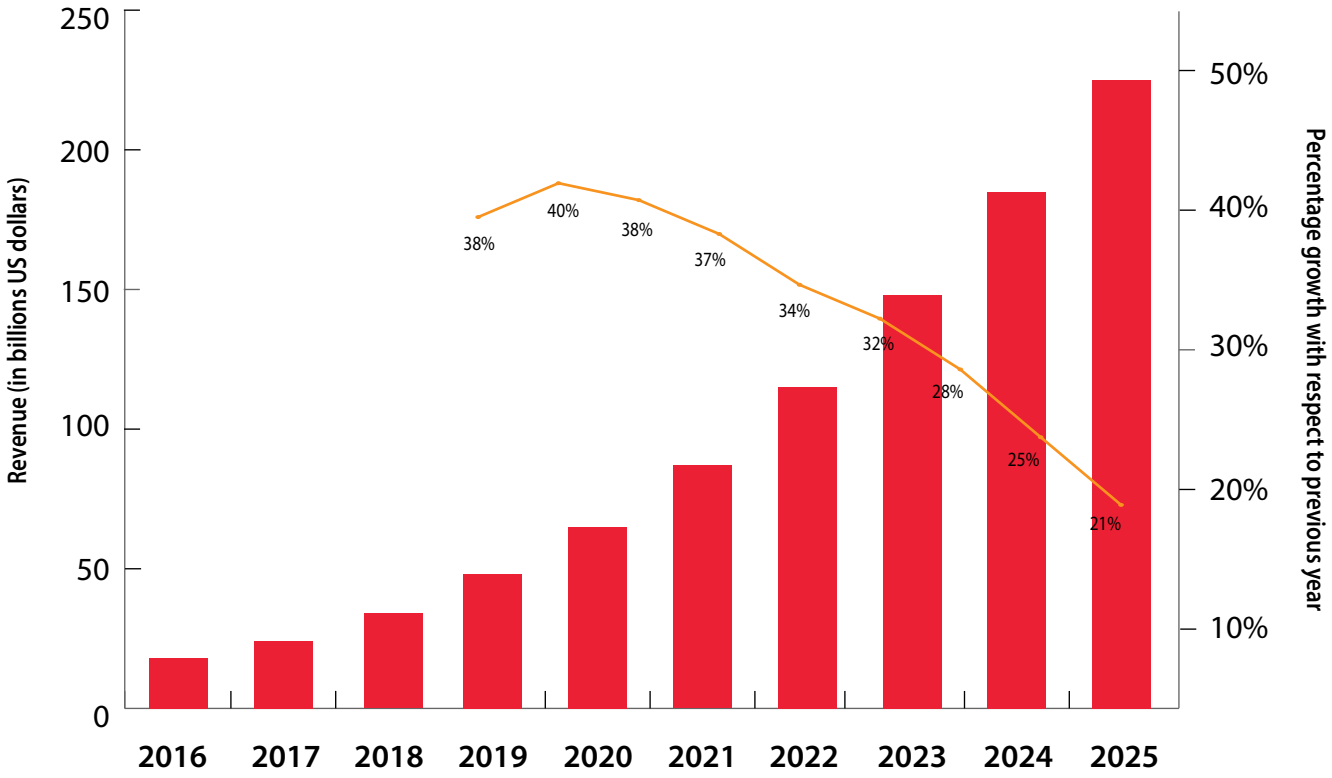
90 Gartner (2020), *Size of the public cloud computing services market from 2009 to 2022 (in billion U.S. dollars).* Available via Statista at: https://www.statista.com/statistics/273818/global-revenue-generated-with-cloud-computing-since-2009/, (accessed on June 26th, 2021).

91 Global Market Insights (2021). *Cloud Computing Market size in Europe to hit $140bn by 2028.* Available at https://www.gminsights.com/pressrelease/europe-cloud-computing-market, (accessed on April 15th, 2021).

92 *Ibidem.*

93 INSEE (2016), Cloud computing, big data : de nouvelles opportunités pour les sociétés. Available at https://www.insee.fr/fr/statistiques/2672067#:~:text=En%20France%2C%20en%202016%2C%2017,calcul%20de%20serveurs%20informatiques%20distants, (accessed on June 26th, 2021).

Figure 7: Revenue generated by public IaaS services from 2016 to 2025 (bars, in billion U.S. dollars) and percentage change with respect to the previous year (line, in %)



Source: Statista[94]. Notes: * Forecast.

128. In Europe, the cloud computing industry is far from maturity, and IaaS services are projected to generate $75 billion in revenue by 2026, growing at an annual rate of 14% from 2019.[95]

129. Amazon entered IaaS as a way to better exploit their internal computing infrastructure.[96] When Amazon launched Amazon Web Services (AWS) in 2006, its Elastic Compute Cloud (EC2) allowed clients to rent for the first time virtual machines online and use their own programs and applications.[97] Amazon kept its incumbency advantage over the years and remains today the biggest provider of IaaS services. Other smaller firms, like OVHcloud or Aruba, also caught the first wave of the cloud computing revolution.

94 Statista (2020), *Technology Market Outlook: Infrastructure as a Service.* Available at: https://www.statista.com/outlook/16110/100/infrastructure-as-a-service/worldwide, (accessed on June 26th, 2021).

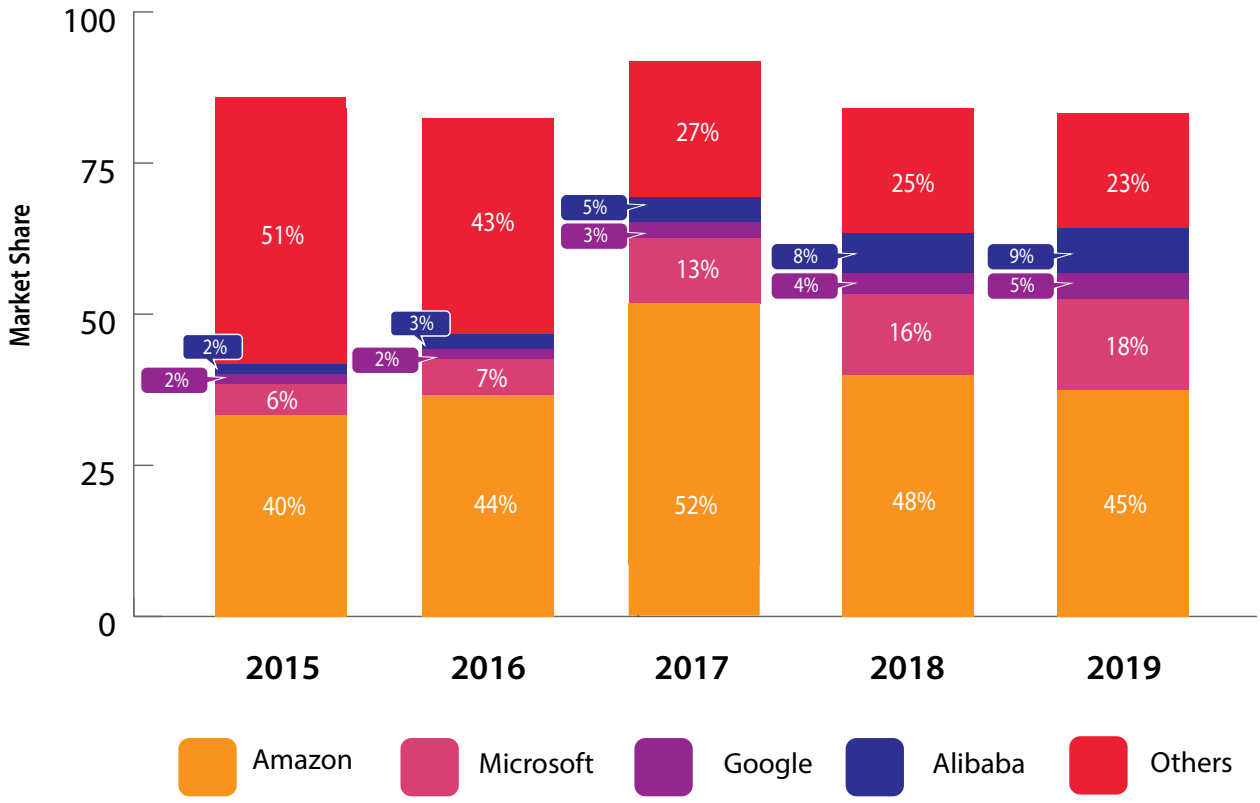
95 *Global Market Insights (2019), Cloud Computing Market revenue in Europe to exceed USD 75 Bn by 2026: Global Market Insights.* Available at: https://www.globenewswire.com/news-release/2019/11/28/1953517/0/en/Cloud-Computing-Market-revenue-in-Europe- to-exceed-USD-75-Bn-by-2026-Global-Market-Insights-Inc.html, (accessed on June 26th, 2021).

96 TechCrunch (2016), *How AWS came to be*. Available at https://techcrunch.com/2016/07/02/andy-jassys-brief-history-of-the- genesis-of-aws/, (accessed on June 26th, 2021).

97 Another of Amazon Web Services' sited was called Amazon Mechanical Turk which is It is a crowdsourcing marketplace that makes it possible for clients to outsource their works to a distributed framework that can execute these activities efficiently. See for example: https://www.mturk.com/ (accessed June 25th, 2021).

130. A few years later, with the number of cloud users growing exponentially, large companies such as Google (in 2008) and Microsoft (in 2010) developed their own cloud offerings. However, their growth had been relatively slow for the first half of the 2010's. For Microsoft, things changed around 2014, when the new CEO Nadella made Azure and other cloud-related products a strategic priority. As Figure 8 shows, Microsoft experienced extremely fast growth in the last five years. Remarkably, Microsoft's share in the public IaaS market worldwide soared from 5.8% in 2015 to almost 18% in 2019, with the highest growth among all different providers. This growth happened at the expense of smaller providers (grouped as "Others" below), who underperformed when compared to segment's overall expansion. At the same time, Google and Alibaba also developed stronger cloud offerings.

Figure 8 : Market share for public IaaS market worldwide (2015-2019)

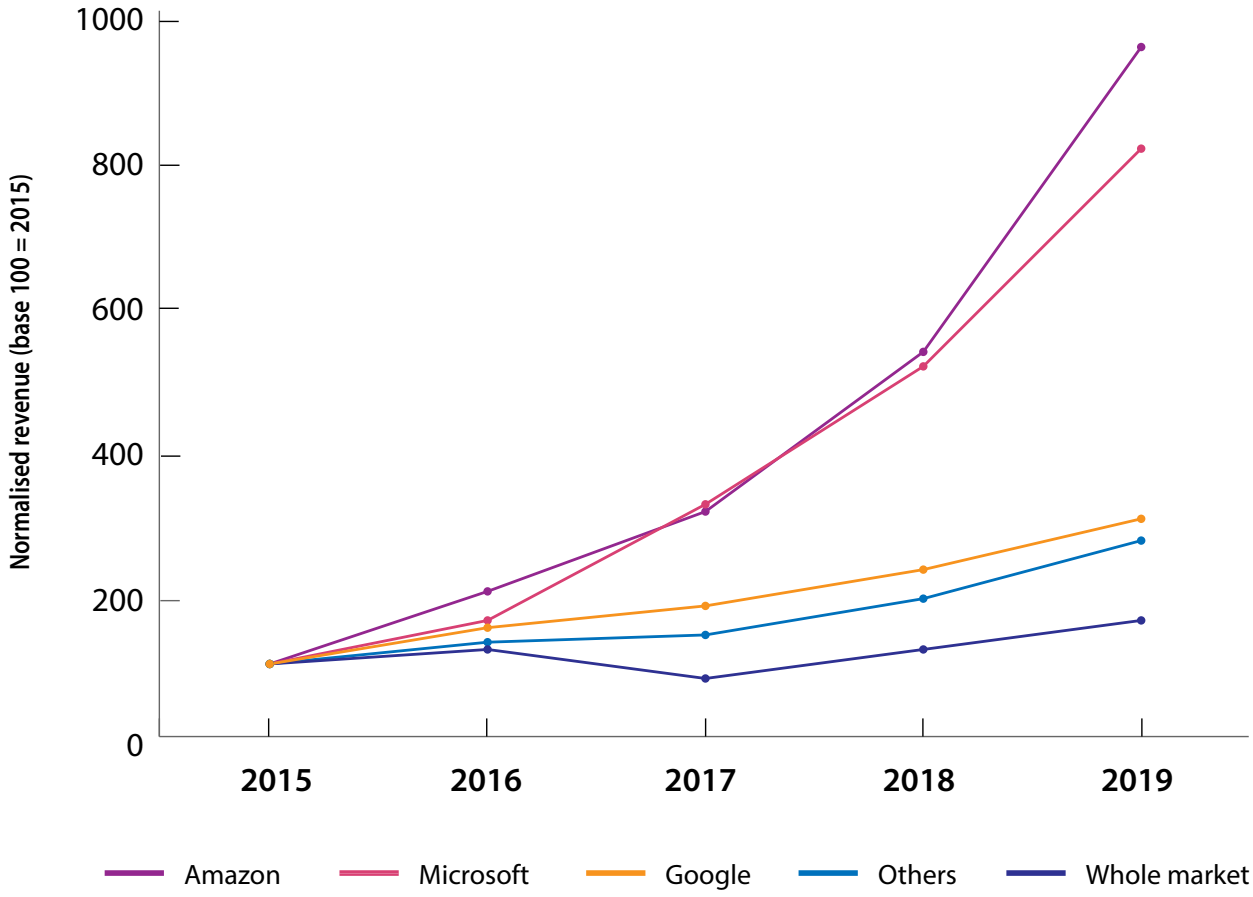


Source: Gartner[98]

131. Figure 9 shows in detail how Google and Microsoft outperformed its competitors. Whilst the overall IaaS segment grew by 265% over the past five years, Microsoft and Google each grew by more than 800%. Despite its growth, however, Google Cloud is still far behind Amazon AWS and Microsoft Azure. Providers other than the big four (i.e., Amazon, Alibaba, Google and Microsoft) grew more slowly, with revenues increasing by 160% over the same period.

98 Statista (2020), *Vendor share of the public cloud infrastructure as a service (IaaS) market worldwide from 2015 to 2019.* Available at: https://www.statista.com/statistics/754837/worldwide-public-cloud-infrastructure-services-vendor-revenues/, (accessed on June 26th, 2021).

Figure 9: Normalised growth of IaaS revenue worldwide for different providers (2015-2019, 2015 = 100)



Source: Gartner[99]

132. Finally, companies with a strong presence in other adjacent software segments, such as Oracle and Cisco, have subsequently started to offer cloud computing services. Given their later debut (2016 and 2017, respectively), they may have greater incentives to try to leverage their presence in adjacent software segments to drive revenue growth from their cloud solutions.

5.3 SAAS MARKET SIZE AND SHARES

133. The SaaS market in Europe exceeded 18 billion Euros in 2019, up 15% from the previous year.[100] According to the recent European Commission DMA Impact Assessment, the number of companies using SaaS has steadily increased over the years: from 51% in 2011 to around 80% in 2019 (at least 1 application hosted on the cloud), with an additional 12% of companies estimated to do so in 2020, bringing the expected total to over 90%.[101]

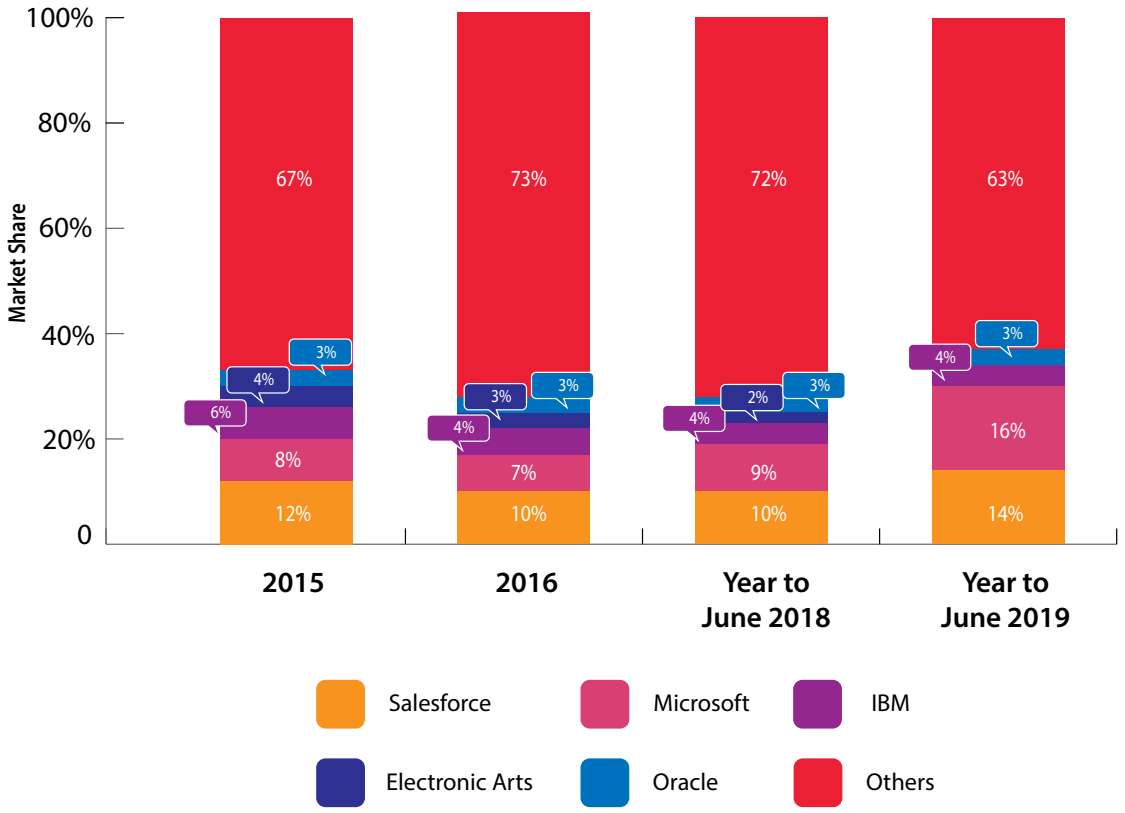
99 Gartner (2020). *Revenues from public cloud infrastructure as a service (IaaS) market worldwide from 2015 to 2019, by vendor (in million U.S. dollars).* Available at: https://www.statista.com/statistics/754826/worldwide-public-cloud-infrastructure-services-vendor- revenues/, (accessed on June 26th, 2021).

100 NTT Data (2020), *Cloud transformation roadmap: Cloud strategy trends in Europe.* Available at: https://de.nttdata.com/files/2020-en-wp-cloud-transformation-roadmap.pdf. (accessed on June 26th, 2021).

101 Publications office of the EU (2020). *European Commission Digital Markets Act - Impact assessment support study - Annexes.* Accessed at https://op.europa.eu/en/publication-detail/-/publication/0a9a636a-3e83-11eb-b27b-01aa75ed71a1/language-en on May 20th, 2021. Figures are sourced from IDG Research Services.

134. Although information on market shares is scarce in this sphere, at the worldwide level Microsoft appear to be the market leader in SaaS with 16% of market, followed by Salesforce (14%), IBM (4%) and Oracle (3%). Since 2015, Microsoft and Salesforce's market share have increased rapidly in the SaaS cloud segment while IBM maintained a constant share, with Oracle's mildly decreasing.[102] The Commission expects an increasing shift to the PaaS/SaaS potentially reinforce Microsoft's position vis-à-vis Amazon (AWS), a clear main rival leading in the IaaS space.[103]

Figure 10: Market share for SaaS market worldwide (2015-2019)



Source: Statista

102 Publications office of the EU (2020). European Commission Digital Markets Act - *Impact assessment support study - Annexes.* Available at www.op.europa.eu/en/publication-detail/-/publication/2a69fd2a-3e8a-11eb-b27b-01aa75ed71a1/language-en (accessed on May 20th, 2021). Figures are sourced from Statista.

103 Publications office of the EU (2020). *European Commission Digital Markets Act - Impact assessment support study - Annexes.* Available at www.op.europa.eu/en/publication-detail/-/publication/2a69fd2a-3e8a-11eb-b27b-01aa75ed71a1/language-en (accessed on May 20th, 2021). Figures are sourced from IDG Research Services.

135. However, these aggregated market shares hide the sub-segmentation of the SaaS market into multiple software categories. Indeed, the degree of substitutability between different SaaS products may be very low. In particular, some software can be considered as necessary for some users, who have little to no alternative. In these cases, even a provider with a low overall market share can leverage its power of its product niche to engage in unfair or anti-competitive practices.

136. Lastly, we may note that in line with this demand-side segmentation, cloud service providers may be categorised by the types of customers they serve. For example, some non-integrated providers specialised in serving digital native clients and provide offerings that can be tailored to their needs.[104] On the other hand, companies such as Microsoft offer solutions that provide for seamless migration for their offline clients.[105] While the hardware infrastructure is the same for both migration and native customers, the type of offer, especially as it pertains to after-sales and software components, seem to differ.

Further copies of this report can be accessed and downloaded from https://cispe.cloud/studies/fairsoftware

104 See OVHCloud webpage: https://www.ovhcloud.com/, (page accessed on June 26th, 2021).

105 See Microsoft Azure Support: https://azure.microsoft.com/en-us/migration/migration-journey/, (page accessed on June 26th, 2021).