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Competition in the Provision of Cloud Computing Services – Background Note

- by the Secretariat -

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Competition in the provision of cloud computing services

Cloud computing is vital to the digital transformation of the economy. The rapid expansion of the cloud computing sector has raised competition questions, particularly as the market has become concentrated among a few major cloud providers across many jurisdictions. High market concentration, barriers to entry, and switching barriers (such as complex migration processes and interoperability limitations) have attracted the attention of competition authorities. Certain business practices, such as high fees for moving data off the cloud and restrictive licensing policies, have also drawn attention for their potential to reinforce customer lock-in, making it difficult for businesses to migrate or adopt multi-cloud strategies.

This paper examines key challenges in the sector and explores how competition authorities can develop effective strategies to promote fair competition, ensure innovation, and support diverse markets.

Keywords: cloud computing, competition in digital markets, competition and innovation.

JEL codes: K21, L15, L40, L86, O33.

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Executive Summary

1. Cloud computing services are central to the digital economy, supporting customers from existing businesses, new digital-first enterprises and governments. The digital transformation of the economy has fuelled a growing demand for flexible and convenient access to computing resources (typically referred to as “compute”) and data storage. In response to this trend, cloud computing services have rapidly expanded as businesses and governments adopt them, alongside the rise of cloud-native startups.

2. At the same time, the rapid expansion of the cloud computing sector has raised competition questions, particularly as a few major cloud providers continue to consolidate their market position. Through market studies and similar activities, several competition authorities have found that the cloud computing services market is characterised by a high level of concentration among a few major providers, dubbed the cloud *hyperscalers*. These firms, including Amazon Web Services (AWS), Microsoft Azure, and Google Cloud, are subsidiaries of large firms active that offer many other digital services.

3. Competition authorities have begun to examine whether hyperscalers’ significant financial resources and integration across digital ecosystems could influence their ability to maintain or strengthen their market positions. One of the primary potential competition issues in the cloud computing sector is the presence of switching barriers. Customers often face technical, contractual, and financial obstacles when attempting to migrate from one cloud provider to another, which may limit customer mobility and reduce competition. Additionally, the lack of standardisation and interoperability between different cloud services, along with digital security concerns, may also contribute to these challenges, making it difficult for customers to integrate services across multiple providers.

4. Another significant concern is the pricing structure of cloud services, particularly the use of fees for moving data out of a provider’s cloud (known as egress fees). These fees, charged for transferring data out of a cloud provider's infrastructure, may be prohibitively high and act as a de facto penalty for leaving the service. This practice can increase switching costs and may contribute to customer lock-in. Moreover, concerns have also been raised regarding the use of free credits and volume discounts offered by cloud providers to attract new customers, suggesting that these practices may create competitive imbalances.

5. Several competition authorities; including France, Japan, Korea, the Netherlands, Spain, the United Kingdom (UK), and the United States (US); have conducted market studies to better understand the competitive dynamics of the cloud sector. These studies have highlighted where there may be a need for regulatory interventions to address potential competition concerns. Potential measures include enhancing data portability, promoting interoperability, and ensuring transparent and fair business practices.

6. Cloud computing services offer significant benefits, driving innovation and greater productivity. As such, it is crucial to assess potential competition concerns associated with this rapidly growing market.

7. This paper examines key challenges in the sector and explores how competition authorities can develop effective strategies to promote effective competition, ensure innovation, and support diverse markets.

8. The paper is organised as follows: **Section 1** provides the factual background on the cloud computing sector's role in the digital era and the competition authority's interest. **Section 2** defines cloud computing services and explains how the business model for cloud computing services operates. **Section 3** considers the relevant markets in cloud computing services and outlines common characteristics of cloud markets. **Section 4** surveys the competition issues that may be present in cloud computing service markets. **Section 5** considers the tools available to competition authorities and highlights authority activities taken to date. **Section 6** concludes.

9. The main points addressed in the paper are as follows:

- Cloud computing services serve as a key infrastructure in the digital economy, characterised by high levels of market concentration, with a few global hyperscalers capturing a significant market share across many jurisdictions.
- Hyperscalers benefit from economies of scale and scope, integration across various digital services, which may influence competitive dynamics in this sector.
- These market features have raised certain competition concerns, such as barriers to switching providers, limitations in interoperability, and the potential anti-competitive behaviours that could reinforce provider lock-in.
- Pricing structures, particularly egress fees and cloud credit programmes, may influence customer behaviour and affect competition.
- Competition authorities have shown interest through methods like market studies to gain insights into these market dynamics. These studies support the conclusion that there are potential risks for competition and can inform both enforcement and regulatory strategies.
- A balanced approach that combines regulatory measures, including initiatives aimed at enhancing interoperability and data portability, with enforcement action as needed, could be considered to effectively address these concerns.

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1 Introduction

10. Digital transformation and increased utilisation of digital technologies and data is significantly impacting existing economic activities and shaping new activities. The development, deployment, and adoption of technologies like artificial intelligence (AI) and the Internet of Things provide vast potential for enhancing productivity, driving scientific discoveries, addressing climate change, improving public services, creating new business models, and enabling remote work, education, and healthcare (OECD, 2024[1]).

11. Cloud computing (often simply "the cloud") is a technology central to digital transformation. The cloud refers to the various services that make information technology resources accessible on-demand to users via an Internet connection – rather than the customer purchasing their own physical hardware or software. This includes (but is not limited to) storage of data, access to servers, and the provision of software.

12. According to OECD estimates, in the past decade the information communication and technology (ICT) sector has on average grown three times faster than the total economy across OECD members, including over the COVID-19 pandemic period (OECD, 2024[1]). Work from competition authorities suggests that cloud computing services have grown even faster that other ICT services, noting revenue growth figures such as:

- 25% annual growth in France (Authorité de la concurrence, 2023[2]),
- ~22% annual growth in Japan (Japan Fair Trade Commission, 2022[3]),
- 20~25% annual growth in Korea (Korea Fair Trade Commission, 2022[4]),
- 20-30% annual growth in the Netherlands (Netherlands Authority for Consumers and Markets, 2022[5]),
- 35-40% annual growth in the UK (Ofcom, 2023[6]).

13. It is difficult to understate the growing demand for cloud services, particularly in the years since the start of the COVID-19 pandemic. The cloud is an indispensable part of the value chain for much of the digital technologies that businesses and governments use each day (such as email, file storage and productivity software). Cloud services have the potential to drive innovation and enhance productivity, particularly for Small and Medium Enterprises (SMEs) that may have been unable to afford the ICT needed to fully benefit from digital transformation (OECD, 2024[1]). Further, the cloud has and will continue to underpin developments in AI technologies. For AI firms, the cloud provides access to the necessary compute and infrastructure to both train and deploy their AI models globally.

14. International Data Corporation, a major market intelligence firm that covers the ICT sector estimates that in 2022, cloud services amounted to around 30% of IT spending globally, rising to 47% of total spend by 2027 (Ofcom, 2023[6]). Well-functioning cloud infrastructure is crucial for driving productivity growth, with cloud technology underpinning many recent innovations, including data science and AI (Ofcom, 2023[6]).

15. This shift towards the cloud appears to be driven first by existing businesses and governments adopting this technology based on its convenience. The cloud computing service model enables users to rapidly adjust their IT resources as needed, without the inherent limitations of upfront investments in their own IT infrastructure. There is also a newer generation of businesses whose operations are only possible

thanks to the lower initial startup costs of operating on the cloud, and do not face the same challenge of the older organisations that are migrating to the cloud (Authorité de la concurrence, 2023[2]). According to the (Authorité de la concurrence, 2023[2]; Netherlands Authority for Consumers and Markets, 2022[5]; Ofcom, 2023[6]) and (Japan Fair Trade Commission, 2022[3]), to date, cloud computing services have attracted the attention of competition authorities for three primary reasons. The first is simply that the widespread migration and usage of cloud computing services means that the market has quickly become critical technical infrastructure needed for many businesses and areas of government to function.

16. The second is that across many OECD jurisdictions, a small number of firms share a consistently high market share, characterising these markets as highly concentrated. Amazon and Microsoft's cloud computing services are reported as having a combined market share of up to 80% in some of the largest OECD economies, with Google commonly the third-largest player (Authorité de la concurrence, 2023[2]; Netherlands Authority for Consumers and Markets, 2022[5]; Ofcom, 2023[6]). Competition authorities that have scrutinised the sector become concerned that large tech firms, the so-called cloud *hyperscalers*, have been able to use their size and power across the digital ecosystem to develop a strong position in the cloud services market across jurisdictions.

17. Finally, authorities have observed that the provision of cloud computing services is undertaken through business practices and contractual frameworks (particularly in relation to the pricing of services) that may create unnecessary levels of lock-in for customers and barriers to entry for competitors.

18. To date, activity by competition authorities relating to cloud computing services has primarily been exploratory in nature, in the form of market studies and similar reports. This paper aims to synthesise the research and findings across jurisdictions to date. It also surveys the potential competition and regulatory interventions that authorities may look to use when addressing competition concerns in the cloud computing services market.

19. The paper also builds on and complements past OECD work related to this topic. The OECD Competition Committee has previously held discussions relevant for this topic. This includes the intersection of data portability and competition policy (OECD, 2021[7]); the evolving concept of market power in digital sectors (OECD, 2022[8]); and the understanding of abuse of dominance in digital markets (OECD, 2021[9]). Artificial Intelligence (AI), a technology fundamentally dependent on cloud computing services to function at scale, is an ongoing topic of acute interest for the Competition Committee. This includes a 2024 session on the intersection of AI, data and competition (OECD, 2024[10]).

2 The Cloud Computing Ecosystem

2.1. Defining the cloud

20. Cloud computing services is a wide term that can capture a vast array of technologies and service offerings (OECD, 2014[11]). Cloud computing refers to a service model:

> *for enabling on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. (Mell and Grance, 2011[12])*

21. There are five essential characteristics of the cloud (Mell and Grance, 2011[12]). These are:

- On-demand self-service: Users can independently access computing resources like server time and storage when needed, without requiring help from the service provider.
- Broad network access: These resources are available over the Internet and can be accessed using various devices such as smartphones, tablets, laptops, and desktops.
- Resource pooling: The service provider pools its computing resources to serve multiple users, dynamically assigning and reallocating resources based on demand. Consumers do not typically know or control the exact location of these resources, but they can specify a higher-level location (like a country or data centre).
- Rapid resource redeployment: Resources allocated to a consumer can be quickly scaled up or down to match usage demand. For users, resources appear to be virtually unlimited and can be accessed in any quantity at any time.
- Measured resource usage: Cloud systems automatically manage and optimise resource usage through metering, allowing the monitoring, control, and reporting of resource usage. This provides transparency for both the provider and the user regarding the consumed services.

22. To date, competition authorities have been consistent in focusing their efforts on a similar set of cloud computing services, which will be the focus of this paper. The cloud computing services that have been subject to competition authority scrutiny to date are *public* and *hybrid* cloud services. In essence, this refers to services (or collections of services) that are offered for use by the general public and are managed by a third-party cloud provider (or in the case of hybrid services, in collaboration with a customers' on-premises infrastructure). A private cloud, by contrast, refers to an organisation setting up its own cloud that it manages and operates for its own exclusive use (Mell and Grance, 2011[12]).

23. Cloud services are also broken down into three categories, based on the amount of responsibility for service provision between the cloud service provider and the customer. The three service categories, from least to most outsourced (Mell and Grance, 2011[12]), are:

- Infrastructure-as-a-service (IaaS): where the cloud services supplier provides the IT infrastructure only (e.g. servers and storage). The consumer does not manage or control the underlying cloud infrastructure, but is free to deploy the operating systems, applications and software as they see fit.

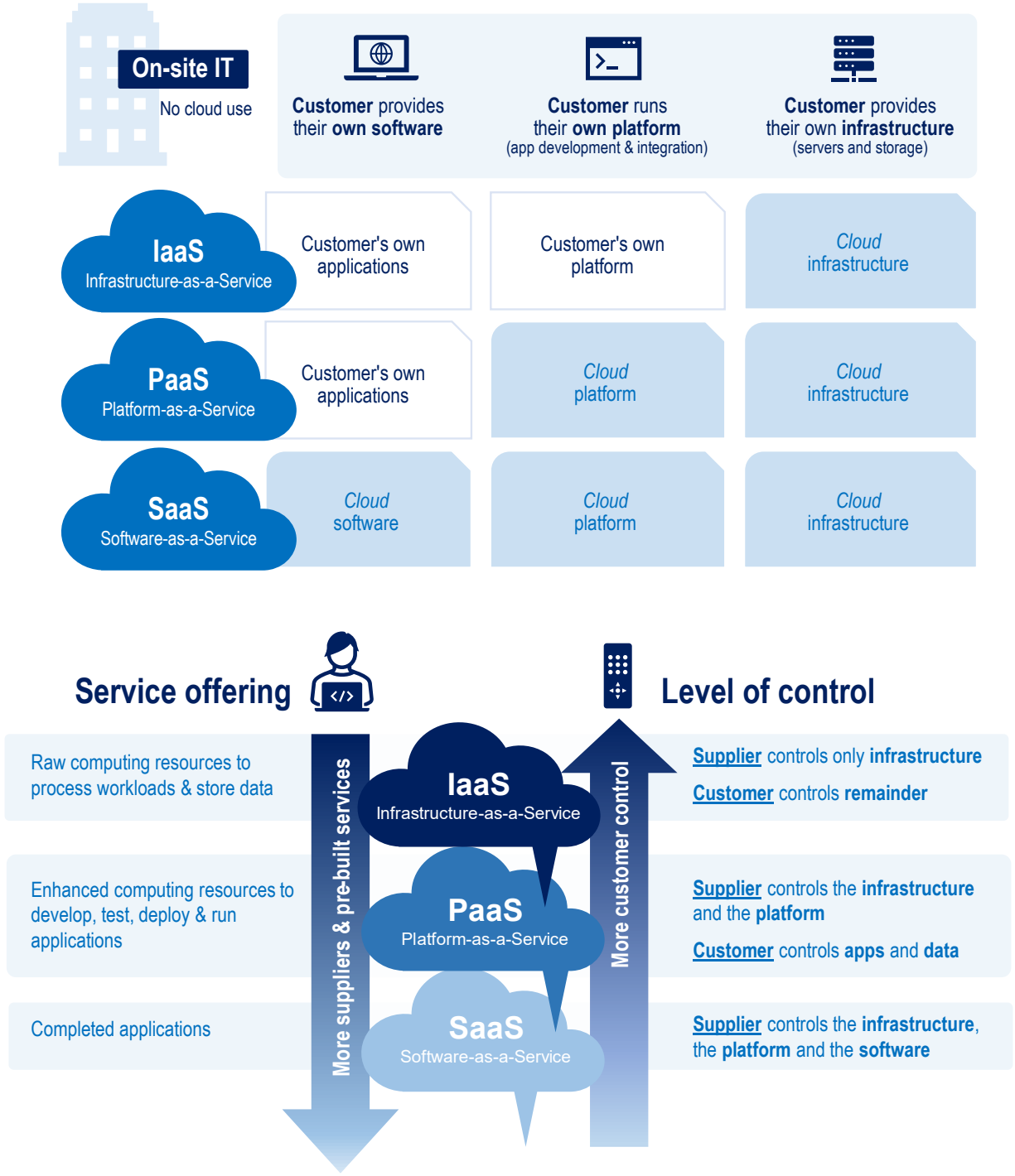
- Platform-as-a-Service (PaaS): where the cloud service supplier provides the platform and tools for the customer to develop and run their applications. The consumer controls only the applications and their configuration settings, not the underlying cloud infrastructure such as network, servers, operating systems, or storage.
- Software-as-a-Service (Saas): where the cloud service supplier is responsible for supplying and managing the application used by the customer. The consumer has no control over the cloud infrastructure, including network, servers, operating systems, storage, or software capabilities, except for limited user-specific settings.

24. IaaS and PaaS cloud services are typically intended to be used by the IT professionals within businesses and governments, who then use the cloud for all or part of their organisation's IT needs. An example of an IaaS would be offering an empty server for anyone in the customer organisation to store data. An example PaaS would be a database platform that allows a customer to use the database for their business needs; but without any need to think about updates, storage capacity and back-ups.

25. SaaS in comparison is primarily intended for use by a broader range of end-users, including all members of the public. Moreover, SaaS offerings are more diverse in natures, reflecting the variety of software available via the cloud. Examples of cloud SaaS services would be a subscription to an office desktop publishing software with remote file storage for use on any device, or a streaming video application.

26. Figure 1 below is a visual aid to differentiate between the three categories of cloud computing services.

Figure 1. Visualisations of the three cloud computing services categories



Note: There is no hard separation between these categories (and indeed some suppliers may apply different categories to similar services), these images are intended only as a visual aid.
Source: Created by the OECD, adapted from Netherlands Authority for Consumers and Markets (2022), Market Study Cloud services, Netherlands Authority for Consumers and Markets, Ofcom (2023), Cloud services market study - Final report, Ofcom

27. This paper, in line with the work of various competition authorities to date, primarily focus on the IaaS and PaaS models of cloud computing services (Authorité de la concurrence, 2023[2]; Ofcom, 2023[6];

Netherlands Authority for Consumers and Markets, 2022[5]; Japan Fair Trade Commission, 2022[3]; Korea Fair Trade Commission, 2022[4]). This is because these service models, their use cases, customer types, and business models tend to be more standardised and comparable, resulting in broadly similar market dynamics and policy considerations. That said, while the primary emphasis is placed on IaaS and PaaS due to the commonality of the issues observed, this paper will also refer to SaaS services, where relevant.

2.2. Actors in the cloud computing services value chain

2.2.1. The users of cloud computing services

28. There is no uniform way to define the users of cloud computing services, as the cloud may be useful to any organisation that has any IT systems. Across the market studies and reports to date, cloud computing service providers responding to requests for information have reported a range of characteristics of their customers.

29. Cloud computing services are used by customers of all sizes. In general, larger organisations (both private firms and government) appear to have the highest and fastest adoption rates of cloud computing services. As well as being more likely to use the technology compared to SMEs (Netherlands Authority for Consumers and Markets, 2022[5]), large organisations are the dominant source of revenue. In the UK, the (Ofcom, 2023[6]) market study noted that the top 1% of customers in terms of spending account for the majority of revenues at all of the leading cloud providers.

30. Organisations from all sectors of the economy are now users of cloud computing services. Some industries have greater use cases for the cloud. Eurostat figures report that fields such as education, professional services and real estate activities use cloud computing services at much higher rates compared to construction and retail trade.[1] Additionally, some industries (such as healthcare and financial services) have stricter regulations how organisations store and use data, meaning they may have more complex needs for specialised cloud services. Governments may also have specialised cloud needs based on public procurement requirements. Countries such as France have adopted a *cloud at the centre doctrine*, meaning the "*cloud will now be the default hosting and production mode for the French government's digital services, for all new digital products and for products undergoing substantial evolution*" (Autorité de la concurrence, 2023[13]).

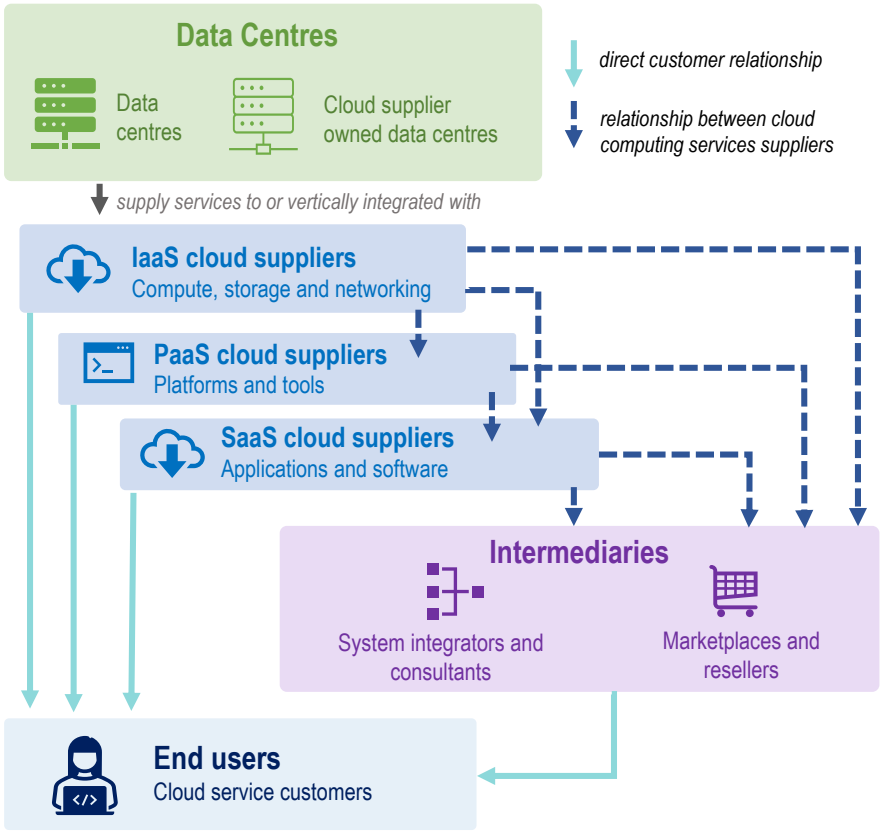
31. Beyond size and sector, customers are often split between firms migrating to the cloud and those native to the cloud. For migrating firms, this involves moving some or all their existing IT workloads that are run on their premises to the cloud.

32. By contrast, cloud natives are newer enterprises that have established all their IT systems directly in the cloud from the start. The flexibility and scalability offered by the cloud have significantly benefited many cloud natives, who do not have legacy systems that must be updated as their IT demands grow. Cloud natives have become a key focus for cloud service providers, thanks to their enthusiastic adoption of cloud tools, data-centric operations, and agility due to the lack of legacy systems to modify.

2.2.2. Suppliers in the cloud computing value chain

33. Figure 2 below sets out the players along the value chain in the cloud computing services market. They are described in greater detail in the remainder of this section.

Figure 2. Visualisation of cloud value chain



Source: Prepared by the OECD. Adapted from Authorité de la concurrence (2023), Opinion 23-A-08 of 29 June 2023 on competition in the cloud sector, Authorité de la concurrence, https://www.autoritedelaconcurrence.fr/en/opinion/competition-cloud-sector (accessed on 22 January 2025), Ofcom (2023), Cloud services market study - Final report, Ofcom

2.2.3. Data centres

34. A data centre is the main physical infrastructure necessary to operate cloud computing services. Data centres are typically operated by specialised firms who have the expertise to design, build and operate the centre. This requires large upfront investments in real estate and IT hardware, and may take years to build. Major operators own multiple data centres across countries, providing standardised services for international customers, which cover the space rental (and other related services such as internet connection, electricity usage, security, and air conditioning to cool the hardware).

35. Data centres are used by actors across the digital economy, not just the public and hybrid cloud computing service providers. Other major users of data centre include communication network operators and providers of services such as video streaming and social networking applications that place their content delivery networks(CDNs) in data centres (OECD, 2023[14]). For this reason, market studies to date have viewed data centre providers as upstream of cloud computing service providers and out of scope. Nonetheless, some cloud computing service companies are vertically integrated upstream and operate their own data centres. These do not compete directly with traditional data centre operators, as their facilities are exclusively used for their own needs.

2.2.4. Cloud service providers

36. Providers of cloud computing services are not a monolith with a single offering. As noted above, cloud computing services can be offered in various models (IaaS, PaaS, or SaaS), with different providers offering an extensive array of services and deployment models, while others may be far narrower in their offering to customers.

37. Across the globe, cloud industry stakeholders use the term hyperscaler to refer to the three largest providers of cloud services (i.e. Amazon Web Services, Microsoft Azure and Google Cloud). These companies belong to larger digital services companies. As noted by the French Authorité de la concurrence,

> *All three belong to major digital companies that are among the world's largest market capitalisations. They already have a strong presence in digital services markets and have leveraged their considerable financial resources and internal needs to build up IT capacity worldwide and offer a large number of diverse cloud services, which have subsequently formed ecosystems. (Authorité de la concurrence, 2023[2])*

38. Beyond the hyperscalers, there is also a range of other competing cloud services providers offering services. These can generally be categorised as medium-scale players who tend to be active in other digital services markets (e.g. IBM and Oracle); and small-scale *pure players* whose only business is cloud computing services (these tend to vary much more between geographic jurisdictions) (Netherlands Authority for Consumers and Markets, 2022[5]). These *pure players* tend to specialise in offering their services in a smaller geographic area (e.g. focused only on one country/region) or only to clients in a specialised industry or with specialised use cases (e.g. financial services or AI model deployment).

2.2.5. Intermediaries

39. In addition to customers being able to directly contract with cloud computing service providers, a number of different types of intermediaries exist in the value chain.

40. The first group can be referred to as integrators, who offer services to manage an organisation's migration to the cloud or manage a customer's long-term cloud needs. Services can be provided by generalist firms (e.g. consultancy firms focused on the digital sector or the business services arm of telecommunications providers), firms that specialise in facilitating transitions to the cloud, or the internal business units of cloud computing services providers.

41. Some cloud computing services may also be available through resellers. Customers may use resellers for their cloud needs on the basis that the reseller may offer more tailored packages for the customer's business sector or provide greater technical assistance than that offered by the cloud supplier.

42. A third category of intermediaries are firms that offer a cloud service, but do not themselves own the underlying cloud infrastructure. This could include PaaS suppliers (e.g. a database platform) or SaaS suppliers (e.g. a project management tool) that provide their service using one of the IaaS cloud offerings.

43. Finally, the hyperscalers and some of the medium-scale cloud computing service providers may also offer a marketplace function. Through the marketplace, customers may access specific cloud solutions from the provider of the cloud service (e.g. a specific database platform), as well as cloud services from third party sellers which will then run on the marketplace provider's cloud infrastructure. Third parties wishing to sell on marketplaces typically will need to accept the terms and conditions of the marketplace provider, be interoperable with the cloud systems of the marketplace provider pay some form of commission or transaction fee. Across several of the market studies, evidence gathered by competition authorities suggests marketplaces make up a fraction of 1% of the revenue in the cloud computing services market (Ofcom, 2023[6]; Authorité de la concurrence, 2023[2]).

2.3. The business model of cloud computing services supply

2.3.1. Standard form contracting

44. Contracts in the cloud computing services market differ from the traditional approach to contracting for an organisation's on-premises IT needs. Whilst historically, customers purchased "fixed resources (non-flexible and non-expandable) at a predictable, negotiated cost", they now lease "modular resources (flexible and expandable)" at a variable cost (Authorité de la concurrence, 2023[2]).

45. Although modular in nature, the vast majority of cloud computing services contracts are standard form agreements (Authorité de la concurrence, 2023[2]; Netherlands Authority for Consumers and Markets, 2022[5]; Japan Fair Trade Commission, 2022[3]; Ofcom, 2023[6]). Using the website of a cloud supplier, a customer can review the standard terms and conditions of service and enter into an agreement without scope for negotiating. These contracts are typically open-ended and can be cancelled at any time.

46. For larger customers with sizable cloud computing needs, there can be some negotiation of the contract terms and conditions. While it is usually not the whole contract that can be negotiated, large customers can typically seek discounts in exchange for a spending commitment. These contracts are usually set to run for one to three years. The hyperscalers Google and Microsoft also offer many IT services customers may also need to run their organisation (e.g. office productivity software or email services), so they also offer better contractual terms to customers that agree to acquire multiple IT services from the hyperscaler.[2]

2.3.2. Pricing structure

47. Users of cloud computing services are charged on a pay-as-you-go model, often referred to in the sector as *pay per use*. Customers are invoiced (typically monthly) based on their actual usage, e.g. per gigabyte of server storage or per second of computing power. Customers are billed according to a tariff schedule, with the price set according to a range of factors. As an example, pricing cloud server storage will "*often depend on how often access to data has to be provided, the volume involved, and whether or not a premium option is used. There are also other (additional) tariffs if the data is then also processed*" (Netherlands Authority for Consumers and Markets, 2022[5]).

48. Cloud services providers often publicise pricing information online. However, customers find it hard to predict their needs and usage due to the pay-per-use model. To help, many providers offer calculator tools and consultancy services to estimate and reduce costs (Ofcom, 2023[6]; Authorité de la concurrence, 2023[2]). The extent to which pricing complexity creates competition issues is discussed in section 4.1.

49. To date, competition authorities scrutinised two aspects of cloud computing services pricing, firstly the costs of moving data, and secondly the practice of offering free cloud credits (Netherlands Authority for Consumers and Markets, 2022[5]; Japan Fair Trade Commission, 2022[3]; Authorité de la concurrence, 2023[2]; Ofcom, 2023[6]; Korea Fair Trade Commission, 2022[4]).

2.3.3. Pricing the movement of data

50. There are three categories of data flows in the cloud computing services market. Data can be moved into the cloud, moved internally across the supplier's cloud, and transferred from the cloud to an external location. Across cloud suppliers, there is a consistent approach to how these three different categories are priced.

51. Data being uploaded or placed into the cloud is referred to as *ingress*. Across providers, ingress fees are not charged, so as to incentivise users adding data to their cloud services. The cost for moving data internally within a supplier's cloud service is less consistently priced, though they are not a major

revenue source. Typically, fees are charged based on whether the internal data transfer means data needs to be relocated to a different cloud server (e.g. moving data from an American server to a European server).

52. The most expensive fees and the ones that drive revenue in relation to data transfer are the fees charged for moving data out of cloud infrastructure – called *egress* (Netherlands Authority for Consumers and Markets, 2022[5]; Japan Fair Trade Commission, 2022[3]; Ofcom, 2023[6]; Authorité de la concurrence, 2023[2]). Egress fees can be charged when:

- Data leaves the cloud to deliver it to an end user or application (e.g. the end-user of a streaming video service watching a movie).
- Data moving from the cloud to a customer's on-premises data storage facility or computer storage.
- Data moving between clouds, either when a customer uses multiple cloud services from different suppliers, or when a customer has decided to switch to a different cloud supplier.

53. Competition authorities have consistently found that cloud computing services suppliers have a data transfer pricing model focused on egress fees. These market studies report that fees far out exceed the actual costs of facilitating egress (noting figures of an up to an 8 000% margin on actual costs), meaning the fees may be operating as de facto penalty for leaving the service (Ofcom, 2023[6]; Authorité de la concurrence, 2023[2]).

54. Additionally, the model of pricing egress fees for customers is based on the amount of data that is transferred, whereas cloud suppliers' costs are linked to their maximum bandwidth (i.e., the maximum simultaneous data transfer capacity through their fibre cables). The (Authorité de la concurrence, 2023[2]), citing a report by (Cloudflare, 2021[15]), describes this approach as suppliers charging customers for the amount of water that ends up in the customers' buckets, even though the suppliers' costs are based on the diameter of the hose used to fill the bucket.

55. Section 4.3.1 of this paper addresses the competition issues linked to this practice.

2.3.4. Cloud credits

56. To attract customers to their services, cloud suppliers have developed a practice of offering *cloud credits* to new customers. The value of these credits can differ widely based on the cloud computing services supplier, and the type of customer they are seeking to attract.

57. Across the industry generally, there are inducements to encourage customers to try a cloud supplier's services or to add an additional service to their contract. These may take the form of a small amount of service provided for a limited time at no cost. For small customers, these can often be accessed directly from the website of a cloud supplier and are of a low value. Competition authorities have consistently found these offers available from both the hyperscalers and smaller cloud suppliers. These mirror customer acquisition strategies common across digital services markets, offering initial discounts to sign up to a service.

58. However, the second form of cloud credit schemes has been of greater interest to competition authorities (Netherlands Authority for Consumers and Markets, 2022[5]; Japan Fair Trade Commission, 2022[3]; Authorité de la concurrence, 2023[2]; Ofcom, 2023[6]). Cloud computing services are also keen to attract smaller businesses that they believe have large growth potential, meaning their cloud needs may exponentially increase over time (i.e. start-up and scale-up tech companies). For these potential customers, the monetary value and length of offer for cloud credits is far higher. Using data from (Ofcom, 2023[6]), Table 1 below outlines the cloud credit offers available to firm growth potential.

Table 1. Cloud credit offerings in the UK

Cloud credit offer		Value (USD)
Default offer available on website	Microsoft	USD 200 for 1 month
	IBM	USD 200 for 1 month
	Oracle	USD 300
Programme for start-ups and scale-ups	Amazon Web Services	Up to USD 100 000 for 1 year
	Microsoft Azure	Up to USD 150 000 for 1 year
	Google Cloud	Up to USD 100 000 per year for 2 years
	IBM	Up USD 1 000 a month for 1 year or USD 3 000 per month for 6 months

Source: Ofcom (2023), Cloud services market study - Final report, Ofcom

59. The largest cloud suppliers collaborate with venture capital firms to find new clients, as well as credits for university researchers, students, and graduates. Targeting high-growth potential start-ups carries risks since many may fail. Hyperscalers are best equipped to mitigate this investment risk through portfolio diversification or cross-subsidising losses. Section 4.3.2 of this paper highlights the role cloud credits may play in raising competition concerns in the cloud computing services market.

3 Analysing the Cloud Services Market

3.1. Contours of the product market for cloud computing services

60. Despite the widespread adoption of cloud computing services over the past decade, to date there appear to be few decisions from competition authorities that have had to formally define the overall market relating to cloud services.[3] Given the nature of this paper, it is not possible to authoritatively define what constitutes relevant antitrust markets for cloud computing services. Rather, the paper synthesises the consistent findings from market studies – which have recognised the market is a particularly challenging one to define.

61. A consistent view across market studies to date is that the cloud computing services market should be understood as the foundational elements of the public cloud stack – IaaS (i.e. the processing, storage and raw computing resources) and PaaS (i.e. services to develop, test, run and manage applications in the cloud). These are the cloud computing services which all use cases of the cloud rely on and as Ofcom observed, "*where we currently see the greatest concentration of supply and factors that pose a risk to effective competition*" (Ofcom, 2023[6]).

62. A number of external constraints on the cloud computing services market have been consistently identified (Netherlands Authority for Consumers and Markets, 2022[5]; Authorité de la concurrence, 2023[2]; Ofcom, 2023[6]; Japan Fair Trade Commission, 2022[3]). The first is whether cloud customers could instead opt to use services at the SaaS cloud layer where the end customer relies entirely on the cloud provider to supply the software, platform or infrastructure. However, in general there is weak evidence that the use cases or customer workloads involving software on the cloud are substitutable with IaaS or PaaS. Additionally, the clientele of SaaS is much broader, extending across almost all members of the general public that use the Internet.

63. The traditional IT services approach (i.e. an organisation using their own on-premises infrastructures) or using a private cloud are also viewed as external constraints (Netherlands Authority for Consumers and Markets, 2022[5]; Authorité de la concurrence, 2023[2]; Ofcom, 2023[6]; Japan Fair Trade Commission, 2022[3]). The convenience of the public cloud model, as well as the monetary and time investment required to migrate means that it is unlikely that even the largest customers of cloud computing services would substitute cloud services for their own private alternative.

64. Additionally, there is the fact that cloud computing services are often part of a suite of digital services an organisation needs to function. In their market study, the (Authorité de la concurrence, 2023[2]) noted that the cloud computing services are

> *characterised by the coexistence, on the one hand, of a considerable heterogeneity of services, ranging from basic storage services to a specific service for a customer wishing to comply with regulatory obligations, and on the other hand, of offers that are part of digital ecosystems and grouped offers, which can make the delineation of the relevant market difficult.*

65. In sum, this means that the definition used in the market studies so far are generally focused on joining together cloud computing services that have similar market dynamics and competition policy issues, based on services with similar use cases, customer types, and business models.

3.2. Geographic dimension of cloud markets

66. In principle, the nature of the cloud is for it to be accessible anywhere via an Internet connection. This forces competition authorities to consider to what extent the relevant geographic market is a national, regional or even global one. So far, authorities have formed a view that markets for cloud computing services generally operate at a regional/continental scale rather than at a national level (Japan Fair Trade Commission, 2022[3]; Authorité de la concurrence, 2023[2]; Netherlands Authority for Consumers and Markets, 2022[5]). This is because:

- High speed Internet infrastructure means that data centres in the same geographic region can be used with reduced latency problems for many use cases (i.e. without too great a delay in the time for user data to travel to and from the cloud).
- Suppliers of cloud computing services tend to offer their services in a number of jurisdictions. For the hyperscalers and the medium-size cloud suppliers, this is at a global scale.[4] Even smaller players tend to operate across a geographic region rather than being limited to a single jurisdiction.
- A regional or even global network of cloud infrastructure is necessary to attract the largest users of cloud computing services, who tend to require cloud infrastructure readily available to their workers and end-customers in many jurisdictions, including scope to expand into new territories.
- In the European context, the EU common market and harmonised regulatory framework creates efficiencies for cloud computing services to operate across the region.

67. Nonetheless, there may be contexts, use cases or customer workloads where a domestic market may exist. For example, healthcare and financial services customers may be subject to greater data protection rules that limit the ability to transfer data across borders. Similar policies may apply to government customers, who may also choose services that can ensure data sovereignty and minimise geopolitical risks. These are also contexts where the customer may opt for installing their own private infrastructure on-site to mitigate the risks posed by using cloud services (as noted above in section 3.1).

3.3. Market characteristics

68. Based on the studies of competition authorities, a number of market characteristics of cloud computing services can be observed. Namely,

- that there are high levels of market concentration,
- that cloud computing services are heavily integrated with other digital services,
- that there are high barriers to entry and expansion in the market.

69. These factors, both individually and cumulatively, favor and strengthen the position of the hyperscalers.

3.3.1. Market concentration

70. Across the market studies conducted to date, the national and regional market combined share of the hyperscalers is consistently significant. Table 2 below provides an overview of the market shares reported in a number of market studies, showing these high levels of concentration.

Table 2. Market share of hyperscalers as reported in competition authority market studies

Jurisdiction	Market share of:		
	Amazon Web Services	Microsoft Azure	Google Cloud
France (2021)	46%	17%	<10%
Netherlands (2020)	45%	35%	5%
UK (2022)	Combined 80%		5-10%
	Amazon Web Services	Microsoft Azure	Others
Korea (2021)	62%	12%	Naver 7%
Japan (2020)	40-50%	10-20%	NTT 5-10%

Sources: Authorité de la concurrence (2023), Opinion 23-A-08 of 29 June 2023 on competition in the cloud sector, Authorité de la concurrence, https://www.autoritedelaconcurrence.fr/en/opinion/competition-cloud-sector (accessed on 22 January 2025), Ofcom (2023), Cloud services market study - Final report, Ofcom, Korea Fair Trade Commission (2022), 클라우드 분야 실태조사 결과 발표, https://www.ftc.go.kr/www/selectBbsNttView.do?pageUnit=10&pageIndex=1&searchCnd=all&searchKrwd=%ED%81%B4%EB%9D%BC%EC%9A%B0%EB%93%9C&key=12&bordCd=3&searchCtgry=01,02&nttSn=42705, Japan Fair Trade Commission (2022), Report on Fact-Finding Survey on Trade Practices by Digital Platform Operators Report on Trade Practices in Cloud Services Sector Contents

71. While Google Cloud's market share is significantly lower than the other two hyperscalers, the three firms are consistently grouped together by stakeholders and competition authorities. This is largely due to the fact that Google, as a major multinational technology firm active across many digital markets, shares key structural advantages with the other two. Further, Google has been the only other provider to reach above a 5% market share in several jurisdictions, and its revenue growth trajectory is broadly similar to that of the other hyperscalers.

72. The evidence gathered across OECD jurisdictions shows that cloud computing services is a market that has been experiencing high growth. As noted in paragraph 12 above, the annual market growth rates reported in market studies have varied between 20% and 40% revenue growth per jurisdiction (Authorité de la concurrence, 2023[2]; Netherlands Authority for Consumers and Markets, 2022[5]; Ofcom, 2023[6]; Japan Fair Trade Commission, 2022[3]; Korea Fair Trade Commission, 2022[4]).

73. However, this new growth in demand is being captured predominantly by the hyperscalers. For example, the (Authorité de la concurrence, 2023[2]) reported in their market study that 80% of the "*growth in spending on public cloud infrastructures and applications in France*" was captured by the hyperscalers. More recent analysis from the private-sector data analytics firm *statista* similarly concludes that worldwide, the hyperscalers "*account for more than 60 percent of the ever-growing cloud market, with the rest of the competition stuck in the low single digits*" (Richter, 2025[16]).

3.3.2. Integration with related digital services

74. Cloud computing services exhibit strong complementarities with various adjacent digital products and services, creating an interconnected ecosystem. This interdependence means that market power in one segment — such as office productivity software, database management, or email hosting — could be leveraged into the cloud. Customers may need or may benefit from integrated solutions, meaning the competition dynamics in the cloud market cannot be analysed in isolation from the broader IT ecosystem. The availability, integration, and cost of complementary digital services often determine a user's choice of cloud provider(s), reinforcing the strategic importance of adjacent market power (Netherlands Authority for Consumers and Markets, 2022[5]; Ofcom, 2023[6]; Authorité de la concurrence, 2023[2]).

75. These complementarities have led to increasing vertical integration, with traditional IaaS providers expanding into PaaS and SaaS markets, and legacy software vendors moving upstream into cloud infrastructure.[5] The interconnected nature of cloud services and adjacent software markets may raise the issue of market foreclosure or leveraging (see section 4.4).

76. Many digital products and services are now an indispensable part of the operations of businesses and governments. Cloud computing services are likely to be used alongside services such as email hosting and productivity software. As the hyperscalers all have a substantial presence in a range of digital products and services markets, there are economies of scope that may drive users towards their cloud services.

77. These economies of scope occur not only through the hyperscalers' access to their very large existing base of customers that use their digital services, but also through ensuring seamless integrations between various services they offer. This ecosystem model is common across digital markets and allows the hyperscalers to offer customers a suite of services for many or all of their needs, creating a dynamic where competing *for* the market is of more importance than competing *in* the market.

78. While the network effects in cloud markets differ somewhat from those in typical two-sided digital platforms, cloud computing services still exhibit meaningful network effects through various mechanisms, that influence the behaviour of both customers and the intermediaries referred to in section 2.2.5, namely the independent software vendors (ISVs). These ISVs often develop their services on the infrastructure of the cloud provider with the most users (i.e. the hyperscalers) to maximise their potential audience for software sales. This creates a cycle where the cloud provider with the most users attracts more ISVs, which in turn increases the usage and turnover of the cloud provider's infrastructure services. Additionally, large cloud providers tend to offer richer third-party ecosystems via their marketplaces, which becomes an additional factor in attracting enterprise customers and developers, reinforcing a virtuous cycle of adoption, investment, and innovation within their ecosystems (Netherlands Authority for Consumers and Markets, 2022[5]; Ofcom, 2023[6]; Authorité de la concurrence, 2023[2]).

79. Another network effect in the cloud computing market is related to the familiarity and expertise of developers with specific cloud platforms. Developers tend to prefer platforms they are already familiar with, which often belong to the largest cloud providers. This familiarity is reinforced by targeted offers to universities and students, ensuring that new developers entering the job market prefer to learn about the most widely used cloud platforms. As a result, the hyperscalers benefit from positive network effects that further may strengthen market position (Netherlands Authority for Consumers and Markets, 2022[5]; Authorité de la concurrence, 2023[2]).

3.3.3. Barriers to entry and expansion

80. There are high fixed costs to establish a cloud computing service. Large capital investment is required to establish the data centres, network infrastructure, servers and other hardware components, most of which are sunk costs that cannot be fully recovered upon exit. This may deter entry in the first place, and as a barrier to expansion as this would also require more of these substantial investments. Cloud computing services also involve substantial ongoing running costs, particularly in relation to the high energy requirements needed to power servers, network equipment and cooling systems (Ponemon Institute, 2016[17]).

81. Given their significant financial assets and revenues across a range of digital services, the hyperscalers are in a better financial position compared to almost all potential market entrants (with the exception of the other major international technology companies). Their ability to invest at such scale allows them to realise substantial economies of scale, reducing the marginal costs of operating large-scale cloud services. It also enables them to benefit from volume discounts on key inputs that may not be available to new entrants, particularly in relation to computer hardware currently in high demand such as central and graphic processing units (discussed in more detail at 3.4.1 below). Unless a new cloud supplier or an

existing supplier seeking to expand is prepared to match the investment levels of the largest suppliers, competitors will likely incur higher costs to deliver the same level of service as the hyperscalers (Ofcom, 2023[6]).

82. There may also be economies of scope when providing a wider range of cloud computing services. While different cloud infrastructure offerings (IaaS) may be relevant for different customers and use cases, they are built on the same underlying hardware and technological building blocks. This is also the case for PaaS offerings, suppliers may be able to reuse their existing resources, code, and expertise to offer more services at lower costs. Cloud suppliers offering a range of services at different layers of the value chain may also benefit from these synergies between different service offerings. These economies of scope may drive provider integration (furthering the economies of scope mentioned above) and increase entrenchment, reducing the scope for new entrants to develop competitive offerings (Authorité de la concurrence, 2023[2]).

83. Finally, the hyperscalers also require the same cloud infrastructure to operate their businesses, creating additional economies of scale. Indeed, Amazon launched Amazon Web Services (and with it the modern cloud computing services market) in 2006 to monetise otherwise spare computing and storage capacity that Amazon did not require outside peak periods of demand (e.g. Black Friday and Christmas retail periods) (Netherlands Authority for Consumers and Markets, 2022[5]).

3.4. Competition policy at the intersection of cloud computing services and artificial intelligence

84. A detailed exploration of the relationship between cloud computing services and recent developments in artificial intelligence tools is beyond the scope of this paper. Nonetheless, it is expected that the intersection of these technologies will be of increasing interest to competition authorities in the coming years. This sub-section briefly surveys the intersection between cloud computing services and AI models and applications.

3.4.1. The cloud as underlying technology in AI developments

85. The cloud has and will continue to underpin developments in AI technologies. For AI firms, the cloud provides access to the necessary compute and infrastructure to both train and deploy their AI models globally. At the same time, this demand for computing resources means that AI firms are becoming an increasingly important revenue source for cloud computing services suppliers (OECD, 2024[10]).

86. In addition to the direct growth in demand for cloud computing services driven by AI firms' increased usage, it is expected that AI will drive additional cloud demand growth through new workload opportunities (Ofcom, 2023[6]; Authorité de la concurrence, 2023[2]), such as:

- Cloud customers seeking access to cloud offerings that allow them to directly access AI tools through cloud services (e.g. OpenAI services being offered through the Microsoft Azure cloud marketplace).
- Cloud suppliers offering specific cloud services targeted at customers that want to develop their own AI tools and models (e.g. Google's AI Vertex and Amazon Web Services' SageMaker).
- Cloud suppliers using AI to enhance the functionality and efficiency of their existing services (e.g. utilising an AI model to better predict demand on their resources) or offering their own AI-enhanced services to customers (e.g. a tool that uses AI to analyse customer data stored in the cloud and provides insights).

87. For cloud computing services suppliers, this AI-related growth appears dependent on being able to acquire the most powerful computer chipsets (including graphics processing units and specialised AI

accelerator chips). With just a few firms able to manufacture these advanced chipsets, there have been acute supply shortages (particularly in the aftermath of the Covid-19 pandemic) (Authorité de la concurrence, 2023[2]; Christophe Carugati, 2023[18]; Ofcom, 2023[6]). This means that cloud computing services suppliers are competing amongst themselves and other users of these chips for the limited supply. This may raise barriers to entry for smaller cloud players, who may lack the purchasing power to gain preferential access to purchase the most advanced chipsets currently in high-demand and be unable to buy (or lease access to) enough chips at competitive prices compared to larger cloud players who may secure volume discounts (OECD, 2024[10]; Authorité de la concurrence, 2023[2]). Recognising these supply chain challenges, the hyperscalers have sufficient scale to also begin investing in avenues to manufacture or otherwise self-supply these advanced chips in the longer term (Christophe Carugati, 2023[18]; Amazon, 2023[19]).

3.4.2. The relationship between cloud and AI services

88. There may be competition issues arising from the vertical relationships involving cloud computing servicers suppliers who are also active in the development and deployment of AI models and applications. If a firm holds market power in the upstream cloud market, it might have the ability and incentive to limit its competitors downstream (AI companies) from access to cloud services. There could also be risks of customer exclusion through practices like bundling or tying services. The interoperability and portability of AI solutions will likely be important considerations in the future (OECD, 2024[10]).

89. Beyond these direct concerns that the hyperscalers are establishing themselves as the de facto global suppliers of cloud services to the largest AI firms, there is an additional factor that cloud and AI firms are entering into more formalised partnership arrangements. To date, these partnerships typically involve a cloud hyperscaler making an investment in an AI firm, in exchange for the AI integrating their services through the cloud supplier. Such partnerships could raise concerns in relation to abuse of dominance, through prohibited self-preferencing, tying or bundling practices.

90. A noteworthy example is Microsoft making a multi-billion-dollar investment in OpenAI in exchange for exclusive rights to offer OpenAI's machine-learning models PaaS through Microsoft Azure and to integrate OpenAI into other Microsoft services (Christophe Carugati, 2023[18]). However, a key challenge is that such partnerships may currently fall outside the scope of merger control frameworks. To date, it seems several authorities have been monitoring their potential impact on competition and considering whether intervention would be possible under current legal frameworks (Bundeskartellamt, 2023[20]; OECD, 2024[10]).

4 Competition Issues regarding Cloud Computing Services

91. Section 3 provided an overview of the general competitive landscape in the cloud sector. This section seeks to delve more specifically into the types of competition concerns that arise in practice. It begins by addressing key issues inherent in the cloud computing sector, such as switching barriers, interoperability limitations, and other practices that can potentially limit the development of competition in the cloud markets because of their user lock-in effects. It then analyses how these competition concerns arise in the cloud computing sectors, provides examples, and assesses their implications for markets.

4.1. Switching barriers

92. One of the most significant competition issues in cloud computing is the presence of potential barriers to migration. In the cloud sector, customers rarely switch providers once an initial choice is made, leading to a lock-in effect that could restrict competition. This lock-in effect arises from both technical barriers, such as the need for substantial code modifications due to differences in the application programming interface (API),[6] the lack of standardised data formats and contractual and financial barriers, including egress fees that increase switching costs. These switching barriers can pose challenges both when migrating from one cloud provider to another and when transitioning from a cloud environment back to on-premise infrastructure. These obstacles make it difficult and costly for users to migrate data, limiting a customer's ability to respond to better service offerings or changing needs (Autorité de la concurrence, 2023[13]; Netherlands Authority for Consumers and Markets, 2022[5]; Korea Fair Trade Commission, 2022[4]).

4.1.1. Technical barriers

93. Competition authority market studies have noted that migrating from one cloud provider to another involves technical barriers. Cloud computing services often replace or integrate deeply with a company's internal workflows, making migration complex and resource-intensive. Since cloud services rely on APIs to communicate between systems, these APIs vary across providers, requiring substantial code modifications when transitioning to another provider. This not only increases migration costs but also necessitates retraining personnel to manage and optimise the new environment. These technical barriers vary depending on different levels of the cloud architecture. The PaaS layer, in particular, is highly integrated with other services, making provider switching especially difficult for businesses reliant on PaaS solutions (Autorité de la concurrence, 2023[13]).

94. Beyond these purely technical limitations, the fragmented environment of cloud service offerings may pose an additional challenge. While IaaS solutions are relatively standardised, PaaS (and SaaS) offerings vary significantly across providers in terms of functionality, security, and privacy standards. A cloud service from one provider may serve the same purpose as another but differ in its technical specifications, requiring businesses to reassess compatibility and compliance requirements before

switching. This lack of substitutability among providers further disincentivises migration and may enforce lock-in (Autorité de la concurrence, 2023[13]).

95. Other technical restrictions may also arise, such as the use of proprietary data formats to hinder the portability of a customer's data to an alternative cloud service provider. Services from different providers often do not support seamless data transfer, requiring additional conversion processes, particularly when proprietary or closed standards are involved. Additionally, latency issues, may arise when services from multiple providers must communicate, particularly in time-sensitive applications such as financial transactions. These structural barriers to data portability can exacerbate lock-in, limiting customers' ability to respond to competitive alternatives and potentially distorting competition in the cloud market (Netherlands Authority for Consumers and Markets, 2022[5]).

4.1.2. Contractual and other barriers

96. According to most market studies, the disparity in bargaining power and information asymmetry between hyperscalers and their customers can contribute to the existence of contractual and pricing barriers, potentially reinforcing customer lock-in. One key factor is the complexity of contractual terms, particularly the opaque and unpredictable pricing structures imposed by large providers. Cloud service costs are calculated based on multiple variables, including storage capacity, computing power usage, API calls, and data transfers, making it difficult for customers to estimate the total cost of usage or potential savings from switching providers. The complexity of contract negotiations, frequently shaped by providers' standard terms, may limit customers' ability to access transparent and flexible pricing models, potentially affecting their capacity to make fully informed decisions, particularly when considering migration (Authorité de la concurrence, 2023[2]; Korea Fair Trade Commission, 2022[4]; Japan Fair Trade Commission, 2022[3]).

97. The pricing structure of cloud services is predominantly based on a pay-as-you-go model, wherein users are charged per unit of usage, such as per gigabyte of storage or per second of computing power. (see section 2.3.2) Unlike traditional pricing models in the information and communication technology sector that rely on fixed licensing fees, cloud pricing models provide flexibility by allowing users to pay only for what they consume. However, many cloud providers also offer reserved-instance pricing, where customers commit to a minimum usage level over a fixed contract period, typically one to three years, in exchange for volume-based discounts. Additionally, pricing structures vary significantly depending on factors such as access frequency, storage volume, and the selection of premium options. These complex pricing models may include a range of supplementary fees, for instance, related to data processing, duplication, or transfer (Netherlands Authority for Consumers and Markets, 2022[5]; Authorité de la concurrence, 2023[2]; Korea Fair Trade Commission, 2022[4]).

98. Although the pay-as-you-go model may lower fixed IT costs and can offer users tailored services, it introduces challenges for customers in terms of cost predictability and transparency, particularly when managing multiple cloud services with varying pricing schemes. The variable nature of cloud consumption, coupled with fluctuating demand and time-limited discounts, makes it difficult for businesses to anticipate their long-term expenditures. To address these concerns, many cloud providers offer monitoring tools, such as cost alerts and dashboards, though these services may incur additional fees. Third-party cost management companies specialising in cloud cost management have also emerged, offering advisory services to businesses seeking to optimise their cloud spending. Nevertheless, the inherent complexity of cloud pricing continues to raise concerns regarding transparency, predictability, and the potential for strategic pricing practices to affect competition (Netherlands Authority for Consumers and Markets, 2022[5]; Authorité de la concurrence, 2023[2]).

99. These contractual and pricing barriers may contribute to reinforcing customer lock-in, which in turn can strengthen the position of hyperscalers in the cloud market. The difficulty of switching providers is not only the result of high egress costs but also stems from market structure, where a relatively concentrated cloud sector allows hyperscalers to play a significant role in shaping industry standards and impose

contractual terms favourable to them. As a result, competition in the cloud services sector could be affected, with possible implications for customer choice and innovation. The combined effects of pricing opacity, high exit costs and complex migration processes may raise potential concerns regarding market dynamics in the cloud computing sector, suggesting that these issues could merit closer regulatory consideration to support effective competition (Autorité de la concurrence, 2023[13]; Japan Fair Trade Commission, 2022[3]).

100. That said, not all such concerns necessarily fall within the scope of competition law. In some cases, they may be addressed through consumer protection or commercial law. For instance, the (Autorité de la concurrence, 2023[13]) has noted that unbalanced contractual terms could be pursued under restrictive trade practice laws, which do not require a finding of market dominance or anti-competitive effect, but rather focus on fairness in business relations.

4.2. Lack of Interoperability

101. Interoperability in cloud computing refers to the ability to exchange and utilise data, applications, and software tools across different cloud environments, while data portability enables their seamless transfer between providers. Although distinct, these concepts are closely linked, as greater interoperability facilitates portability (see section 4.1).[7] Challenges related to interoperability and portability in cloud computing have prompted increasing interest in standardisation as a potential means to support a more competitive and open cloud ecosystem (Netherlands Authority for Consumers and Markets, 2022[5]) (see section 5.4).

102. While standardisation presents both benefits and risks from a competition perspective, the absence of widely adopted technical standards and standardised protocols may limit users' ability to integrate services across multiple providers, thereby contributing to the development of proprietary cloud ecosystems. Industry-wide standards, such as the Open Virtualization Format (OVF)[8] exist at the infrastructure layer, interoperability at the platform and software layers often remains constrained by proprietary interfaces and vendor-specific orchestration solutions. This is largely due to the use of proprietary interfaces and vendor-specific orchestration tools, which may restrict customers' ability to integrate services across different providers and, in turn, give rise to lock-in effects (Ünver, 2017[21]; Song, 2017[22]).

103. Some studies suggest that multi-cloud strategies, where customers rely on different cloud providers for different parts of their operations, may help mitigate lock-in risks (Bhagat, 2024[23]). According to a report from cloud management firm Flexera, customers most frequently cite the siloes between cloud services and a lack of interoperability as the reason they need to adopt a multi-cloud strategy (Flexera, 2025[24]).

104. While multi-cloud strategies may offer certain benefits, such as reduced dependency on a single provider, they do not necessarily eliminate the underlying barriers. In fact, the use of multiple providers may give rise to new forms of fragmented lock-in, as customers encounter interoperability issues, high egress fees, and a lack of standardised APIs across platforms. These challenges are particularly pronounced in the context of IaaS or PaaS services, where integration tends to be more complex. However, that interoperability is both more critical and generally more feasible at these lower layers of the cloud stack, compared to SaaS, where more proprietary value is embedded and IP-related constraints may make standardisation more difficult. In the absence of effective interoperability, customers may be unable to seamlessly combine services from different providers or choose the offerings best suited to their needs (Autorité de la concurrence, 2023[13]; Netherlands Authority for Consumers and Markets, 2022[5]).

4.3. Pricing Issues

4.3.1. Egress fees

105. One of the most significant components of cloud pricing is “data transport fees”, as most providers do not charge for ingress, but costs are incurred when data is transferred within or outside of the cloud[9] (see section 2.3.3). These fees apply not only when switching cloud providers but also in routine operations, such as streaming content or sharing data externally. The tiered differentiated pricing structures for data transport may create additional complexities, making it challenging for users to anticipate or compare the long-term costs associated with cloud service usage across providers (Netherlands Authority for Consumers and Markets, 2022[5]).

106. Beyond this complexity, several market studies have noted that such fees may disproportionately shift infrastructure costs onto customers. These costs arise in a variety of contexts, including data transfers across different cloud providers in multi-cloud environments, migrations to alternative providers, data repatriation to on-premise infrastructure in hybrid-cloud scenarios, and even routine transfers to end-users. By offering comparatively low upfront prices while imposing high exit costs, major providers may increase barriers to entry, ultimately reinforcing their market concentration (Autorité de la concurrence, 2023[13]; Netherlands Authority for Consumers and Markets, 2022[5]).

107. The French and Dutch market studies referred to the EU Data Act (European Commission, 2025[25]), which mandates a gradual phase-out of such fees. The French market study has noted and appeared to be supportive of national legislative efforts aimed at restricting the application of such fees. Taking a different approach, the UK CMA did not propose a direct prohibition on egress fee. Instead, it proposed designating AWS and Microsoft as having Strategic Market Status (SMS) under the Digital Markets, Competition and Consumers Act 2024 (DMCC Act),[10] which would enable targeted regulatory interventions. The Dutch market study further considered whether egress fees could, under certain circumstances,[11] constitute an abuse of dominance. These developments suggest that both ex-ante regulatory measures and ex-post competition law enforcement may be relied on to address the competitive concerns arising from egress fees and their detrimental impact on customer mobility (Netherlands Authority for Consumers and Markets, 2022[5]; Authorité de la concurrence, 2023[2]; Competition and Markets Authority, 2024[26]).

4.3.2. Cloud Credits

108. Some market studies have raised concerns about the potential effects of cloud credit schemes, and competition authorities are primarily paying close attention to the second type of cloud credits mentioned earlier, which offer substantial benefits specifically targeted at start-ups and scale-ups (see section 2.3.4). While such credits may generate efficiency gains by lowering initial adoption costs and encouraging experimentation with cloud services, concerns arise regarding their potential anti-competitive effects (Autorité de la concurrence, 2023[13]; Netherlands Authority for Consumers and Markets, 2022[5]).

109. Concerns mainly focus on the scale and structure of these programmes. Hyperscalers frequently offer cloud credits at levels considerably exceeding those that non-hyperscalers can sustainably match, sometimes by a factor of up to ten. Additionally, these credits are often conditional on substantial purchase commitments or exclusivity clauses, restricting customers to using services exclusively from one provider for a specified duration. Under these circumstances, cloud credits may resemble loyalty rebates. Certain competition authorities have considered them to constitute an extreme form of loyalty rebates, as they can allow for entirely free consumption of cloud services, which has been subject to scrutiny under competition laws due to their potential to foreclose market access for equally efficient competitors (Autorité de la concurrence, 2023[13]).

110. Nevertheless, overly interventionist approaches toward such pricing practices could inadvertently harm consumers, particularly by restricting opportunities available to startups and potentially reducing innovation in the market (Antonio Manganelli, 2024[27]). Given the current absence of formal enforcement actions or definitive findings regarding market dominance in relation to these practices, it remains premature to reach conclusions. Competition authorities, therefore, need to continue to closely monitor these concerns, carefully balancing potential pro-competitive and anti-competitive effects before taking regulatory actions.

4.4. Market Power Leveraging and Foreclosure

4.4.1. Exclusionary licensing practices

111. The integration of software and cloud services may give rise to potential competition concerns, particularly where software vendors with significant market power could leverage their market position through licensing practices that may disadvantage competing cloud providers. Given that many cloud services rely on software licenses issued by major software publishers, these vendors may have the ability to impose unilateral licensing terms that affect the competitive dynamics of the market.

112. An example often cited in this context is Microsoft's licensing policies, which have been cited as a potential means to raise competitors' costs (Autorité de la concurrence, 2023[13]; Japan Fair Trade Commission, 2022[3]; CISPE, 2022[28]). In 2019, Microsoft altered its Bring Your Own License (BYOL) policy,[12] limiting customers' ability to use Microsoft software on third-party cloud infrastructure through contractual limitation. This change coincided with the launch of its own infrastructure service, Azure Dedicated Host, effectively incentivising customers to maintain or renew licenses within the Azure ecosystem. Some have argued that such practices could increase competitors' costs and potentially raise barriers to entry in cloud markets (Autorité de la concurrence, 2023[13]; Japan Fair Trade Commission, 2022[3]; CISPE, 2022[28]).

113. Further concerns have been raised regarding software vendors' use of licensing policies that may impose financial disincentives on customers who choose to use rival cloud providers. For instance, it has been alleged that Microsoft modified its licensing terms after a company opted for Amazon Web Services, requiring them to pay for individual Office licenses per computing instance, leading to significant additional costs (Knuth, 2023[29]; CMA, 2024[30]). Another potential exclusionary tactic involves imposing software licensing surcharges on competitors' cloud products, making it more expensive for rival cloud providers to offer their services. Some market studies and commentators have noted that they may also have exclusionary effects, by raising rivals' costs and limiting customers' ability to exercise choice (Autorité de la concurrence, 2023[13]; Japan Fair Trade Commission, 2022[3]). While concerns have been raised, to date, there do not appear to be any formal findings of competition law infringements regarding these practices.

4.4.2. Bundling and Tying

114. Some commentators have focused on competition concerns related to the risk from bundling and tying practices in the cloud computing sector (CISPE, 2022[28]). The practice of bundling, where multiple products or services are offered together at a discounted rate, may occur when integrated providers combine widely used software with cloud infrastructure services. Such arrangements may disadvantage independent providers, who typically need to license equivalent tools separately and may incur higher costs. For example, by integrating collaboration tools into broader cloud service packages at a lower combined price, large providers may make it more difficult for independent cloud providers to compete effectively. (Jenny, 2021[31]) and (Feinstein, 2010[32]) have argued that such bundling practices could produce conglomerate effects, whereby companies leverage their position in adjacent markets such as software or the on-premises market, to reinforce their position in cloud infrastructure.

115. Tying, which occurs when the purchase of one product is conditioned on the mandatory use of another, has also been cited as a potential competition issue in cloud computing. This may involve contractual obligations that require proprietary software to run exclusively on a provider's own infrastructure, or through technical optimisations that favour performance within a provider's ecosystem. (CISPE, 2022[28]) and (Jenny, 2023[33]) have pointed to the integration of Microsoft Teams with Office 365, which prompted complaints on the grounds that Teams was pre-installed and not made available separately (see Box 1). Similarly, Oracle's licensing policies have been criticised for linking software licenses to maintenance contracts, making it difficult for customers to mix service levels without incurring additional costs (CISPE, 2022[28]; Authorité de la concurrence, 2023[2]).

Box 1. European Commission's Investigation into Microsoft Teams

In 2017, Microsoft released a new communication and collaboration tool Microsoft Teams and made it available for customers as part of its popular productivity suite Office 365. In 2019, Microsoft initiated the gradual phasing out of Skype for Business Online, focusing on the promotion of Teams.

Following a complaint by Slack Technologies, the provider of a competing product to Teams, the European Commission announced on 27 July 2023 that it had opened a formal investigation into Microsoft's conduct. The investigation concerns the alleged tying of Teams to Microsoft's productivity suites, Office 365 and Microsoft 365. According to the Commission, customers were not given a choice whether or not to include access to Teams when they subscribed to Microsoft's productivity suites. Teams was automatically included in the Office 365 and Microsoft 365 suites, and this gave rise to a concern that Microsoft may have abused and defended its market position in the productivity software by tying Teams to its popular productivity suites, giving Teams a distribution advantage and restricting competition for communication and collaboration products. By bundling Teams with its popular productivity suites, Microsoft may have reduced customer incentives to consider alternative products, thereby limiting customer choice and potentially disadvantaging competitors.

Shortly after the European Commission had opened the investigation, Microsoft announced adjustments to address the Commission's concerns. Effective on 1st October 2023, Microsoft unbundled Teams from Microsoft 365 and Office 365 suites for new customers in the EEA and Switzerland, offering the productivity suites without Teams while enabling a separate standalone purchase of Teams. Existing customers were given the option to retain their bundled version or switch to a version without Teams at a lower cost. On 1st April 2024, Microsoft extended this policy globally.

Despite these changes, the European Commission, on 25 June 2024, issued a statement of objection that tying of Teams to Microsoft's productivity suites may constitute a breach of EU competition law. Microsoft has offered commitments, which the Commission is currently market testing.

Source: European Commission (2023), "Antitrust: Commission opens investigation into possible anticompetitive practices by Microsoft regarding Teams", https://ec.europa.eu/commission/presscorner/detail/en/ip_23_3991; European Commission (2024); "Commission sends Statement of Objections to Microsoft over possibly abusive tying practices regarding Teams", https://ec.europa.eu/commission/presscorner/detail/en/ip_24_3446; Microsoft (2017), "Microsoft Teams rolls out to Office 365 customers worldwide", https://news.microsoft.com/2017/03/14/microsoft-teams-rolls-out-to-office-365-customers-worldwide/.

4.5. Competition concerns in relation to marketplaces

116. Many cloud service providers operate marketplaces that enable third-party publishers to offer complementary services and applications, thereby enhancing the provider's ecosystem while also granting them control over access conditions. As these marketplaces grow in importance, some stakeholders have

raised concerns that certain conditions imposed by providers may limit competition. These may include controls over which services can be marketed, restrictions on promotional activities or enforcing technical and licensing requirements. For example, it has been reported that some providers, such as AWS and Oracle, have included clauses limiting third-party publishers' ability to directly promote their services, while Google Cloud Marketplace has imposed stringent product eligibility criteria (Autorité de la concurrence, 2023[13]; Netherlands Authority for Consumers and Markets, 2022[5]; Korea Fair Trade Commission, 2022[4]).

117. These restrictions might be justified on grounds such as security, quality assurance, intellectual property protection, or ensuring a consistent user experience. However, concerns have been raised that, in certain cases, they may also result in unfair access conditions, erect barriers to entry, or disadvantage third-party services in favour of the provider's own offerings. By leveraging control over their marketplaces, integrated cloud providers could influence competition not only through pricing and service availability but also by shaping the overall competitive landscape. These issues have been identified in several market studies as potentially affecting competition in cloud ecosystems (Autorité de la concurrence, 2023[13]; Netherlands Authority for Consumers and Markets, 2022[5]).

5 Instruments available to Competition Authorities

118. This section examines the instruments available to address the competition concerns identified in Section 4. It reviews how competition authorities are currently responding to these challenges through various actions, including market studies, possible enforcement and regulatory initiatives. In doing so, it aims to assess the effectiveness and limitations of existing approaches, and thus, it outlines the broader policy implications, emphasising the importance of fostering competition and innovation while ensuring fair practices in this rapidly growing market.

5.1. Market studies

119. Market studies, while often associated with advocacy, also serve as valuable tools for information gathering and can facilitate the promotion of competition in a market. Given the challenges that may arise in enforcement, such as delays, difficulties in designing effective remedies, and the need to establish dominance, etc. market studies can offer a more flexible and proactive approach in advocating for competition (OECD, 2021[9]).

120. In an increasing number of jurisdictions, they empower authorities to directly intervene and enhance market functioning, particularly in cases where concerns do not arise from clear infringements of competition law but may instead require alternative policy responses, including regulatory reform. By developing a robust evidence base, market studies can lay the groundwork for future interventions, while enabling authorities to deepen their understanding of market dynamics without the immediate need to demonstrate legal violations (OECD, 2024[10]).

121. The main approach competition authorities have therefore taken to assess competition in cloud markets has been through market studies. At the time of writing, authorities in France, Japan, Korea, and the Netherlands have already published cloud market studies, while others, including Spain, the UK and the US FTC, are currently carrying out their assessment, with the UK CMA reportedly in the final stages (FTC, 2023[34]; CNMC, 2023[35]; CMA, 2025[36]). Additionally, various digital competition reports released by competition authorities have included analyses of cloud markets, reflecting the growing regulatory focus on the competitive dynamics of this sector (ACCC, 2024[37]; Cofece, 2024[38]).

Box 2. Market studies on cloud computing services by multiple competition authorities

France's market study in 2023

The French Autorité de la concurrence (Autorité) launched a market study on cloud computing in January 2022 and published its findings in June 2023. The market study highlighted strong market concentration, with AWS, Microsoft, and Google accounting for 80% of growth. It identified structural advantages like economies of scale, network effects, and ecosystem competition that favour large players.

The Autorité introduced a distinction between "trusted" and "non-trusted" clouds based on security certification, while leaving geographic market definition open.

The Autorité categorised competition risks into cross-cutting risks, such as bargaining imbalances due to non-negotiable terms, large-scale cloud credits disadvantaging smaller providers, and egress fees reinforcing lock-in, and scenario-specific risks, including migration from on-premise systems, provider switching, and multi-cloud interoperability challenges.

The Autorité additionally explained potential competition law responses to these competitive risks. They include standard competition tools, such as abuse of a dominant position, cartels, merger control, and a French concept of abuse of economic dependence, as well as regulatory instruments.

Japan's market study in 2022

The Japan Fair Trade Commission (JFTC) conducted its cloud services market study in 2022. It focused heavily on the role of ecosystem dependency and information asymmetry. The study found that hyperscalers had entrenched positions due to network effects, broad service offerings, and lock-in strategies.

Key concerns included lack of transparency in contracts, bundling of functionalities, high data transfer fees, and self-preferencing behaviours regarding software licensing, and other acts detrimental to customer choice and market fairness. The JFTC also stressed the importance of ecosystem dynamics led by cloud providers, involving diverse stakeholders whose businesses are closely integrated with major cloud platforms. This integration often exacerbates competitive challenges, creating dependencies that restrict cloud service customers' ability to switch providers.

In response, the JFTC emphasised ecosystem dependencies and lock-in effects, recommending greater contract transparency, improved data portability, and international cooperation to maintain competition in digital markets.

Korea's market study in 2022

In 2022, the Korea Fair Trade Commission (KFTC) released the results of a comprehensive market study on the cloud computing services sector in Korea. This study analysed market dynamics and trading relationships among 32 cloud service providers and approximately 3 000 stakeholders.

The study also identified significant market concentration in Korea, with AWS holding over 60%, followed by Microsoft and Naver. The findings focused on public and hybrid cloud models, with transactions primarily occurring through Managed Service Providers, which are distribution partners that provide services to support customers in adopting and optimising cloud solutions, rather than through direct dealings or marketplace intermediaries.

Key competition issues included limited interoperability, data portability constraints, and high switching costs driven by technical incompatibility and migration costs. The KFTC also raised concerns about unfair trade practices in contractual relationships.

To address these issues, the KFTC highlighted the importance of proactive regulatory measures to mitigate these barriers, as well as traditional enforcement tools.

Netherlands' market study in 2021

The Dutch Authority for Consumers and Markets (ACM) initiated its market study in 2021 and released its final report in September 2022. It focused on market structure and behaviour, with a unique observation that Microsoft Azure held a dominant 40-45% share in the Netherlands, higher than AWS and diverging from global trends. Cloud adoption is increasing, particularly among large enterprises and the public sector, including education, government, and healthcare.

The ACM highlighted technical and financial switching barriers as key concerns, including closed standards, data incompatibility, and variable egress fees. It also examined how bundling of services across cloud layers (IaaS, PaaS, SaaS) could facilitate leveraging market power.

To address these issues, ACM underscored the importance of standard competition tools, including merger control and abuse of dominance enforcement, particularly concerning egress fees and discount structures. ACM highlighted the role of regulatory interventions, supporting the Digital Markets Act and the Data Act to enhance switching and interoperability, which could mitigate competition risks in the cloud services market.

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5.2. Enforcement

122. To date, completed enforcement actions specifically addressing competition concerns in cloud markets remain limited despite growing attention paid to potential competition concerns. This is not unexpected given the sector's relatively early stage of development, as well as the complexity of identifying clearly anti-competitive conduct in a fast-moving technological landscape. Many authorities are examining market structures, business practices, and potential competition concerns, often through market studies or information gathering exercises, with some cases currently ongoing. Where infringements of competition law are identified, traditional enforcement mechanisms, particularly those concerning abuse of dominance and merger control, could serve as important tools, as they have in other areas of the digital economy.

123. Most market studies suggest that among the various enforcement tools, abuse of dominance is likely to be the most relevant in addressing emerging concerns in cloud services. Previous enforcement experience in digital markets underscores the importance of assessing the degree of market power exercised by firms, their strategic positions across various layers of the value chain, and how certain practices may hinder rivals' ability to scale or access users (OECD, 2024[10]).

124. Most of the competition concerns mentioned in Section 4 appear to fall within the scope of existing and well-established theories of harm related to abuse of dominance, although some contextual adjustments may be required to reflect the technological and market-specific characteristics of cloud services. As market conditions continue to evolve, authorities will need to assess whether these traditional frameworks remain adequate or whether novel approaches might be necessary to address emerging risks.

125. Regarding remedial action, the timing and design of enforcement responses will be critical to their effectiveness. In markets with economies of scale and network effects, monetary sanctions alone may not be sufficient to prevent or reverse harm if firms are able to sustain their market power through control over key inputs such as data, infrastructure, or interoperability standards. In such cases, structural or behavioural remedies, such as ensuring non-discriminatory access to infrastructure or prohibiting anti-competitive conduct, may be more effective. Cloud markets also may give rise to lock-in effects due to scale economies, switching barriers, and interoperability constraints, making timely intervention, including interim measures or commitments, important to preserve effective competition. Enforcement strategies must be carefully tailored to the specific characteristics of cloud sectors, ensuring that interventions effectively address competition concerns without inadvertently stifling innovation or disrupting market dynamics.

5.3. Regulation

5.3.1. Ex-ante regulation

126. To address competitive concerns in cloud markets, policymakers are increasingly considering ex-ante regulation as a complement to traditional competition law enforcement. A key example is the Digital Markets Act (DMA), which aims to prevent anti-competitive practices by imposing obligations on designated gatekeepers—large digital firms with significant market influence (Netherlands Authority for Consumers and Markets, 2022[5]; Authorité de la concurrence, 2023[2]). Cloud computing services are classified as a 'Core Platform Service' under the DMA, meaning that major cloud providers could potentially fall within the scope of potential designation. That said, no cloud service providers have, to date, been formally designated as gatekeepers specifically in relation to the cloud sector (European Commission, 2023[39]).

127. The DMA introduces obligations which could be used to address some of the competition concerns identified in the cloud sector such as preventing restrictions on user switching (Article 6(6))[13] and ensuring effective data portability (Article 6(9)),[14] which could help reduce lock-in effects and enhance competition. Additionally, designated gatekeepers should notify the European Commission of all planned mergers, potentially strengthening oversight of acquisitions in the cloud sector (Article 14).[15]

128. Nevertheless, the extent to which the DMA can effectively address competition concerns in cloud computing remains subject to limitations, even in cases where a major cloud service provider would be designated as a gatekeeper. Some software-specific characteristics, such as market scope and interoperability issues, may limit the DMA's applicability. For instance, even if a firm with a strong position in certain software or on-premise markets were to be designated as a gatekeeper in relation to the cloud sector, its licensing practices, if used to encourage adoption of its own cloud infrastructure, might not be fully addressed under the current provisions. This is because each of player's adjacent products would need to be separately classified as a 'Core Platform Service' to trigger obligations under the DMA. Given these limitations, more traditional competition law tools—such as abuse of dominance- remain still useful in tackling anti-competitive conduct in the cloud market (Netherlands Authority for Consumers and Markets, 2022[5]).

5.3.2. Data Act

129. The European Data Act[16] aims to facilitate the seamless transfer of valuable data between data holders and data users while upholding its confidentiality. The Data Act plays a crucial role in enhancing data portability and interoperability in cloud markets by addressing both technical and financial barriers to switching (European Commission, 2025[25]).

130. The Data Act introduces measures to promote competition in the cloud services sector by obliging providers to eliminate barriers that impede users from switching to comparable services from other providers. This includes removing contractual, technical, organisational, or commercial obstacles, ensuring that users can transfer their data and applications to another provider's IT environment. Providers are also required to charge no more than the direct costs of switching, with a provision that, three years after the Act's entry into force, switching between providers must be free of charge for users (European Commission, 2025[25]).

131. Additionally, the Data Act sets requirements for the technical aspects of switching between data processing services. Providers must guarantee equivalent functionality after switching by using open specifications or interoperability standards, or, if such standards are unavailable, by providing a structured and complete submission of data in an accessible format. This ensures that cloud-service users can switch providers while maintaining the functional quality of their services (Netherlands Authority for Consumers and Markets, 2022[5]). The implementation of the Data Act attempts to address, at least within the European Union, the concerns raised regarding interoperability and data portability in cloud markets.

5.4. Standardisation Issues

132. Interoperability challenges in cloud computing ultimately may lead to discussions on standardisation**,** which plays a crucial role in ensuring compatibility between technology providers (see section 4.2.). Effective standards could enhance market efficiency, foster innovation, and reduce switching costs, ultimately preventing customer lock-in and promoting a more competitive cloud market. While various standard-setting organisations (SSOs) and standards development organisations (SDOs) are working to develop common frameworks for cloud interoperability, the adoption of cloud standards remains fragmented. For example, the European Commission has described the current cloud standards landscape as a "jungle of standards" (European Commission, 2016[40]), reflecting concerns that inconsistent or proprietary standards could reinforce market dominance rather than promote competition (Song, 2017[22]). In some cases, widely used technical standards are not the result of formal industry consensus but are instead effectively established by individual firms.

133. From a competition perspective, standardisation has both benefits and risks in the digital sector. On the one hand, open and widely adopted standards can enhance data portability, interoperability, and service switching, reducing dependency on a single provider. Initiatives such as OpenStack[17] exemplify how open-source cloud frameworks can support competition by enabling cross-provider compatibility. On the other hand, standard-setting may also entail risks. If cloud providers are able to influence or control standard-setting processes, there is a risk that standards could be used strategically to reinforce market concentration, for instance by creating closed ecosystems that limit interoperability with competing services. In addition, network effects in cloud computing may result in certain standards emerging as de facto industry norms, potentially disadvantaging smaller providers or new entrants. More broadly, concerns have also been raised that an excessive reliance on standard-setting may inadvertently hinder competition and innovation by entrenching existing technologies and limiting the emergence of alternative, and potentially superior, technical solutions (Pérez, 2017[41]). In particular, in highly concentrated markets, standardisation, if not carefully managed, could reinforce existing structures. This underscores the importance of appropriate regulatory attention to ensure that standards facilitate, rather than hinder, competition.

134. Given these dynamics, a balanced and coordinated approach to standardisation is essential. Competition authorities need to ensure that cloud standardisation processes remain open and inclusive, preventing dominant firms from using them to exclude rivals or create artificial barriers to switching. At the same time, regulatory frameworks should support the development and adoption of common, open cloud standards that facilitate interoperability without stifling innovation. Since cloud markets operate across borders, balanced international co-operation on standard-setting is necessary to prevent regulatory

fragmentation. By combining competition with proactive regulatory oversight, policymakers can strike a balance that leverages the benefits of standardisation while mitigating its potential anti-competitive risks, ensuring that cloud markets remain contestable, dynamic, and innovation-driven (Ünver, 2017[21]; Song, 2017[22]; Netherlands Authority for Consumers and Markets, 2022[5]).

6 Conclusion

135. Cloud computing has rapidly evolved into a fundamental pillar of the digital economy, enabling businesses, governments, and individuals to access scalable computing resources with unprecedented flexibility. The shift from on-premise infrastructure to cloud-based services has accelerated innovation, enhanced efficiency, and reduced IT costs. However, as cloud services become more essential, competition authorities and policymakers have started to pay closer attention to potential competition concerns arising in this sector.

136. Several competition authorities have sought to identify these concerns and recommend action through market studies, which provide valuable insights into the competitive dynamics of the cloud sector. Several authorities have already conducted in-depth examinations of cloud markets, assessing issues such as market concentration, switching barriers, and restrictive business practices. These studies help inform regulatory and enforcement strategies, ensuring that competition remains robust in the evolving cloud landscape.

137. The cloud computing market is characterised by high market concentration, where a few big-tech providers control a significant share. This has raised concerns over potential anti-competitive behaviours, including restrictive licensing, interoperability challenges, and high switching costs. Customers often face barriers that limit their ability to transition between cloud providers, reinforcing provider lock-in and reducing market dynamism.

138. Certain business practices and pricing structures may pose challenges for new entrants and smaller competitors in the cloud sectors. Addressing these challenges may benefit from a balanced approach that combines competition with, where appropriate, complementary regulatory measures. Traditional competition tools, including merger control and abuse of dominance, remain relevant for assessing and responding to potential competition concerns.

139. In this context, ex-ante regulatory frameworks such as the Digital Markets Act and the European Data Act introduce (at least for the European Union) obligations intended to enhance data portability, interoperability, and market openness in digital markets.

140. Standardisation represents a double-edged sword; while they can support interoperability and market openness, they also require careful oversight to ensure that it does not inadvertently restrict competition or entrench existing market dynamics. Open and widely adopted standards may contribute to lowering switching costs and enabling service integration, thereby promoting competition. At the same time, standard setting may also carry risks of hindering competition and innovation, particularly if it reinforces existing technologies or limits the emergence of alternative solutions.

141. Policymakers may therefore need to adopt a balanced approach that maximises the pro-competitive benefits of standardisation while ensuring that such processes remain open, inclusive, and conducive to innovation. Maintaining interoperability, fostering an open cloud environment, and supporting fair competition will be essential to ensuring that the cloud sector continues to deliver benefits to consumers and businesses alike.

Endnotes

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[2] See for example Microsoft, "What is the Microsoft Open Value program?", https://www.microsoft.com/en-us/licensing/licensing-programs/open-license.

[3] A number of large jurisdictions did review the acquisition by Microsoft of Activision Blizzard Inc. This is the most relevant merger analysis to date, but it is only focused only on the much more narrow market of cloud gaming services. The UK Competition and Market Authority's review of the merger found that Microsoft enjoyed "an estimated 60-70% market share in global cloud gaming services" and that it was "already much stronger than its rivals" (Competition and Markets Authority, 2023[44])

[4] E.g. the AWS website notes it offers services in "245 countries and territories". See AWS (2025), "AWS Global Infrastructure", https://aws.amazon.com/about-aws/global-infrastructure/.

[5] For instance, AWS, initially an IaaS provider, has expanded to offer a suite of PaaS and SaaS offerings. Conversely, Microsoft, traditionally the leading productivity software and computer operating system firm, has extended its footprint into the cloud through its Azure services.

[6] A system interface that allows software components to communicate, enabling the integration of different applications and services (NIST, 2007[43]).

[7] Interoperability and data portability are distinct but interrelated concepts in cloud computing**.** Interoperability enables users to exchange and utilise data, applications, and tools across different cloud environments, facilitating seamless interaction between cloud ecosystems. Data portability, on the other hand, refers to the ability to transfer data, software, and platforms between systems while maintaining usability. Ensuring portability allows users and competitors to reuse components across cloud environments with minimal costs. While interoperability fosters cross-system functionality, portability ensures efficient migration, with multi-layered interoperability serving as a broader framework that inherently supports portability (Gleeson, 2014[46]).

[8] The Open Virtualization Format (OVF) is an open standard for packaging and distributing virtual machines across different virtualisation platforms. It enhances interoperability by enabling seamless migration between cloud providers and on-premise environments, reducing vendor lock-in (DMTF, 2025[42]).

[9] Egress fees vary depending on the volume of data being moved, with providers often offering a limited amount of free transfers (e.g., the first 100GB). For instance, AWS and Microsoft Azure charge $0.09 and $0.087 per GB, respectively, for the next 10 TB—a contrast to alternative providers such as OVH and Scaleway, which charge only $0.01 per GB or none at all.

[10] The Digital Markets, Competition and Consumers Act 2024 (DMCC Act) is a UK legislative framework that came into force on 1 January 2025. It empowers the CMA to designate firms with substantial and entrenched market power in digital activities as having Strategic Market Status (SMS), thereby subjecting them to conduct requirements designed to promote fair competition and consumer choice (CMA, 2024[45]).

[11] The market study by ACM identified various practices in cloud markets that, if conducted by dominant firms, could potentially amount to an abuse of dominance or anticompetitive agreements. These include

discount structures that discourage partial switching to a competitor, denigration of multi-provider use, and the imposition of egress fees. The study also noted that other strategies reinforcing customer lock-in could fall under scrutiny if they are deliberately designed to create switching barriers (Netherlands Authority for Consumers and Markets, 2022[5]).

[12] Bring Your Own Licence (BYOL) refers to a licensing model which allows customers to use software licences that they have previously acquired, typically for on-premise use, within a third-party cloud environment without having to purchase additional licences. Under a BYOL arrangement, customers are expected to ensure that their existing licence terms permit such use in the cloud and may be required to obtain specific authorisation from the software vendor, depending on the licence conditions. In practice, certain software vendors have imposed contractual or technical restrictions limiting the portability of licences to competing cloud service providers. For instance, some argue that Microsoft's licensing terms have included provisions prohibiting or restricting the use of its Windows Server licences on third-party cloud platforms under BYOL, unless the customer has an explicit agreement with Microsoft (CISPE, 2022[28]).

[13] Article 6(6) – Prevention of Switching Restrictions: "*The gatekeeper shall not use technical or contractual restrictions to prevent or limit business users or end-users from switching between or using different software applications and services on the gatekeeper's platform, including through interoperability requirements or other constraints that could hinder switching*."

[14] Article 6(9) – Data Portability Requirements: "*The gatekeeper shall provide end-users, at their request and free of charge, with effective portability of their data generated through the activity of the end-user in relation to the relevant core platform service, including by providing tools for end-users to facilitate the seamless transfer of their data to third-party services*."

[15] Article 14 – Obligation to Notify Mergers: "*A gatekeeper shall inform the Commission of any intended concentration within the meaning of Article 3 of Regulation (EC) No 139/2004 involving another provider of core platform services or of any other services provided in the digital sector, regardless of whether the concentration is notifiable under the Merger Regulation. The Commission shall share this information with the competent authorities of the Member States without delay*."

[16] It was published in the Official Journal of the EU on December 22, 2023, and set to become applicable on September 12, 2025.

[17] OpenStack is an open-source cloud computing platform that enables the deployment and management of public and private clouds. It provides a suite of software tools for building and managing cloud infrastructure, and is designed to promote interoperability and avoid vendor lock-in by allowing users to run the same software across different cloud environments (OpenStack Foundation, 2020[47]).

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