

THE STATE OF CLOUD TECHNOLOGY MARKETS: CHALLENGES FOR COMPETITION



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THE STATE OF CLOUD TECHNOLOGY MARKETS: CHALLENGES FOR COMPETITION

By *Diana L. Moss*

This article unpacks the unique features of the cloud market, including rapid expansion through acquisition, static market structure, and weak merger enforcement. The analysis draws attention to the important link between market structure and conduct and its implications for strategic incentives around market positioning, entry and expansion by smaller rivals, and innovation competition. A major implication is that competition enforcers and policymakers should pursue vigorous merger enforcement, at the same time they look carefully to identify competitive concerns around strategic conduct that could potentially hamper competition in cloud technology.

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I. INTRODUCTION

Cloud computing technology touches virtually every part of human interaction and activity — economic, social, political, and cultural. As compared to previous technological revolutions, the development of the current generation of cloud technology infrastructure was explosively fast. A recent American Antitrust Institute report *The Cloud Technology Market: Storm of Innovation or Rainy Days for Competition?* (“AAI Report”) indicates that cloud acquisitions by companies that hold nontrivial shares of the cloud technology market account for almost 45 percent of their total acquisitions over the last 25 years.² Estimates of year-over-year growth in the value of cloud technology range into the double digits through the rest of the decade.³

Aside from its meteoric rise, the evolution of cloud is marked by a number of distinctive features. First, cloud providers have different business models. There is the digital business ecosystem (“DBE”), where cloud, together with a multi-sided platform and constellation of applications, form an ecosystem of exchange and engagement.⁴ These players include Amazon’s Web Services (“AWS”), Microsoft Azure, and Google Cloud. Other players are more specialized in software and cloud applications, including IBM, Oracle, and Salesforce. The different levels of horizontal, vertical, and ecosystem integration featured in the DBE, versus non-DBE, cloud business models have enormous implications for rivals’ strategic competitive incentives.

Second, the three DBE providers, AWS, Microsoft Azure, and Google Cloud, collectively account for 65 percent of the market while a fringe of smaller providers accounts for the rest. The positioning of the top three firms in the cloud technology market has not materially changed over time. Nor is there any indication that fringe players can amass enough share to even come close to the larger players, much less threaten to displace them. This seems at odds with any policy for promoting competition in innovation in a technologically dynamic sector, especially one that is still in the relatively early stages adoption.⁵

Finally, U.S. merger enforcement in the digital sector, including for cloud technology deals, remains at low levels. This record has worsened over time, with a widening gap between the rate of merger challenges in the digital sector relative to the average across all sectors. This enforcement record for the U.S. Department of Justice (“DOJ”) and Federal Trade Commission (“FTC”) is highly relevant to the past and future trajectory of cloud acquisitions by many of the top cloud providers. This is especially true for the acquisitions of smaller rivals and potential market entrants that have drawn so much scrutiny and criticism.

This article sets the stage for how competition enforcers and policymakers might think about competition in cloud technology. It unpacks the unique features of the cloud market, including rapid expansion through acquisition, different business models, structural market stagnation, and weak merger enforcement. The analysis draws attention to the important link between market structure and conduct and its implications for strategic incentives such as market positioning, entry, and innovation competition.⁶ A major takeaway is that competition enforcers and policymakers should pursue vigorous merger enforcement, at the same time they look to identify competitive concerns around strategic conduct that could potentially hamper competition in cloud technology.

II. CLOUD TECHNOLOGY AND MARKET STRUCTURE

Cloud infrastructure consists of an interconnected set of technologies that allow users to access storage, files, software, and servers remotely through devices connected to the internet. This includes hardware, virtual resources, storage, networks, operating systems, middleware,

2 Diana L. Moss *The Cloud Technology Market: Storm of Innovation or Rainy Days for Competition?*, AMERICAN ANTITRUST INSTITUTE (JUN. 21, 2023), https://www.antitrustinstitute.org/wp-content/uploads/2023/07/AAI-Report-Cloud-Markets_7.5.23.pdf (“AAI Report”).

3 See e.g. Annual spending on cloud IT infrastructure worldwide from 2013 to 2026, STATISTA, <https://www.statista.com/statistics/503686/worldwide-cloud-it-infrastructure-market-spending/> (last visited June 20, 2023).

4 See e.g. Diana L. Moss, Gregory T. Gundlach, and Riley T. Krotz, *Market Power and Digital Business Ecosystems: Assessing the Impact of Economic and Business complexity on Competition Analysis and Remedies*, AMERICAN ANTITRUST INSTITUTE (JUN. 1, 2021), https://www.antitrustinstitute.org/wp-content/uploads/2021/06/AAI_digital-ecosystems_FINALV5.pdf.

5 Glenn Solomon, *The Cloud Is Still a Multibillion-Dollar Opportunity. Here’s Why*, FORBES (JAN. 4, 2023, 12:54 PM), <https://www.forbes.com/sites/glennsolomon/2023/01/04/the-cloud-is-still-a-multibillion-dollar-opportunity-heres-why/?sh=2cbf56947774>.

6 See, e.g., Rohan Goswami and Jennifer Elias, *Google accuses Microsoft of unfair practices in Azure cloud unit*, CNBC (JUN. 21, 2023), <https://www.cnbc.com/2023/06/21/google-accuses-microsoft-of-anticompetitive-practices-in-azure-cloud.html>. See also, *Solicitation for Public Comments on the Business Practices of Cloud Computing Providers*, Docket No. FTC-2023-0028, FED. TRADE COMM’N (MAR. 22, 2023), <https://www.regulations.gov/docket/FTC-2023-0028/document>.

automation, management, and containers.⁷ Major cloud technologies used by businesses include, among others: data analytics, machine learning, software as a service (“SaaS”), virtualization, and artificial intelligence. Cloud technology, therefore, allows businesses to access software and information technology (“IT”), without making large investments.⁸

The table below lists the top cloud providers and their estimated market shares, based on revenue, for 2022. The top two players, AWS and Microsoft Azure, account for 55 percent of the market.⁹ Adding Google Cloud brings the share of the top three players to 65 percent. Alibaba Cloud, IBM Cloud, Salesforce, Oracle, and Tencent Cloud have small shares. The top eight top players thus account for about 80 percent of the market, producing a moderately concentrated market with an HHI of about 1,700.¹⁰

Market Shares of the Top Eight Cloud Providers (2022)

Company	Market Share	Annual Growth in Share (2018-22)	Company	Market Share	Annual Growth in Share (2018-22)	Concentration
AWS	32%	1%	IBM Cloud	3%	-18%	8-Firm Share – 79%
Azure	23%	20%	Salesforce	3%	Declining	3-Firm Share – 65%
Google Cloud	10%	21%	Oracle	2%		2-Firm Share – 55%
Alibaba Cloud	4%	.50%	Tencent Cloud	2%		HHI – 1,695

The dominance of the DBE business model in the cloud technology market is important. DBEs feature three major components: a platform (e.g. E-Commerce, social media, and search and advertising), or multi-sided market that brings together providers and users; cloud infrastructure; and a constellation of applications (e.g. fintech, healthcare, gaming).¹¹ Cloud infrastructure is the “engine” for realizing the value proposition of the digital ecosystems, or monetizing user data through the use of data analytics, artificial intelligence, and machine learning to attract, engage and retain users in the ecosystem.

Year-over-year change in shares of the top cloud players reveal a relatively stagnant cloud market structure. For example, AWS’s year-over-year growth in market share remained flat from 2018-2022. Microsoft Azure and Google Cloud both show significant growth over the same period. However, while Microsoft Azure made gains on AWS, stealing about 2 percent of share from the cloud giant, it remains in second place, while Google Cloud remains in third place.¹² The fringe cloud players show either flat (e.g. Alibaba Cloud), or declining (e.g. IBM and others) growth.

III. THE RAPID BUILDOUT OF CLOUD INFRASTRUCTURE

The expanding value and economic role of cloud technology has prompted rapid expansion through acquisition and organic growth. Cloud acquisitions by the top providers range from small transactions — many of which fall under the federal Hart Scott Rodino Act (“HSR”) reporting

7 See e.g. *What is Cloud Computing?* SALESFORCE, <https://www.salesforce.com/ca/cloud-computing/> (last visited June 20, 2023); see also *What is cloud infrastructure?* RED HAT (May 28, 2019), <https://www.redhat.com/en/topics/cloud-computing/what-is-cloud-infrastructure>.

8 See e.g. *Closing the cloud strategy, technology, and innovation gap: Deloitte US Future of Cloud Survey Report*, DELOITTE, <https://www2.deloitte.com/content/dam/Deloitte/us/Documents/consulting/us-future-of-cloud-survey-report.pdf> (last visited June 20, 2023).

9 See *Big Three Dominate the Global Cloud Market*, STATISTA (Apr. 28, 2023), <https://www.statista.com/chart/18819/worldwide-market-share-of-leading-cloud-infrastructure-service-providers/>; *Cloud Spending Growth Rate Slows But Q4 Still Up By \$10 Billion from 2021; Microsoft Gains Market Share*, SYNERGY RESEARCH GROUP (Feb. 6, 2023), [https://www.srgresearch.com/articles/cloud-spending-growth-rate-slows-but-q4-still-up-by-10-billion-from-2021-microsoft-gains-market-share#:~:text=New%20data%20from%20Synergy%20Research,in%20the%20market%20growth%20rate;Q1%20Cloud%20Spending%20Grows%20by%20Over%20\\$10%20Billion%20from%202022;the%20Big%20Three%20Account%20for%2065%20of%20the%20Total](https://www.srgresearch.com/articles/cloud-spending-growth-rate-slows-but-q4-still-up-by-10-billion-from-2021-microsoft-gains-market-share#:~:text=New%20data%20from%20Synergy%20Research,in%20the%20market%20growth%20rate;Q1%20Cloud%20Spending%20Grows%20by%20Over%20$10%20Billion%20from%202022;the%20Big%20Three%20Account%20for%2065%20of%20the%20Total), SYNERGY RESEARCH GROUP (Apr. 27, 2023), <https://www.srgresearch.com/articles/q1-cloud-spending-grows-by-over-10-billion-from-2022-the-big-three-account-for-65-of-the-total>.

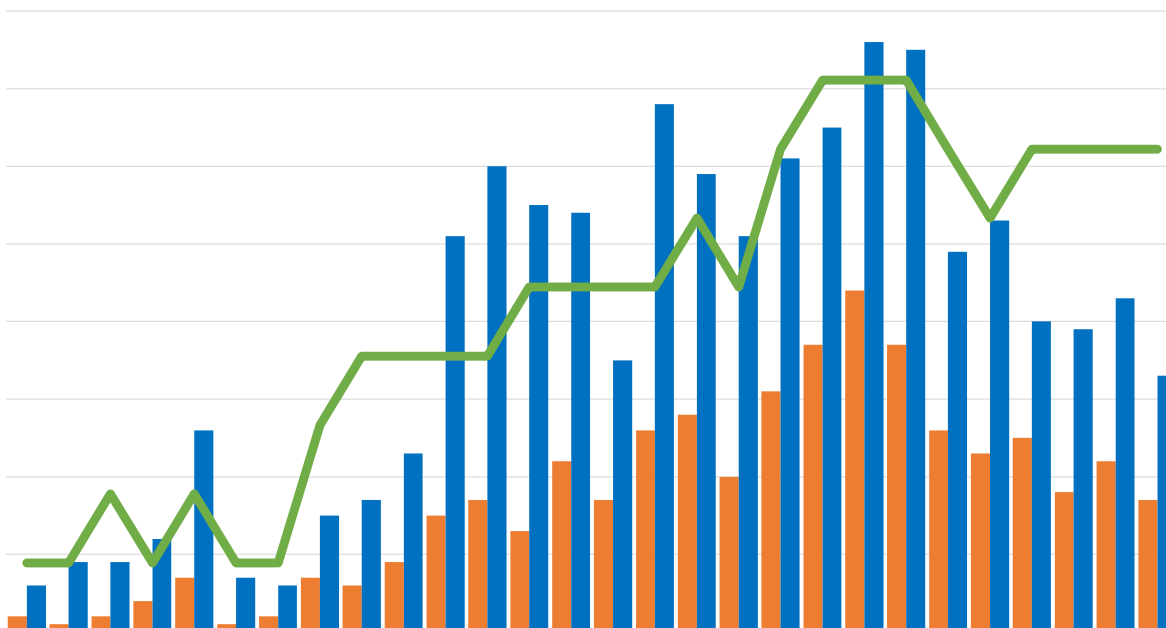
10 See AAI Report, *supra* note 2, at 5. See also, U.S. DEP’T OF JUSTICE & FED. TRADE COMM’N, *Horizontal Merger Guidelines* (Aug. 19, 2010), <https://www.justice.gov/atr/horizontal-merger-guidelines-08192010>.

11 See Moss, Gundlach, & Krotz, *supra* note 4.

12 Ron Miller, *Even as cloud infrastructure market growth slows, Microsoft continues to gain on Amazon*, TECHCRUNCH (Feb. 6, 2023, 2:39 PM), <https://techcrunch.com/2023/02/06/even-as-cloud-infrastructure-market-growth-slows-microsoft-continues-to-gain-on-amazon/>.

thresholds — to some worth almost \$20 billion.¹³ The AAI Report evaluates acquisitions made by the top eight cloud providers over the period 1995-2022. These are shown in the figure below, along with their total acquisitions and the annual “count” of actively acquiring firms.¹⁴

**The Top Cloud Providers:
Total and Cloud Acquisitions (1995-2022)**



The top cloud providers made about 1100 acquisitions from 1995-2022, about 480 of which were cloud assets, or almost 45 percent of the total. The proportion of total acquisitions accounted for by cloud-related deals increased, on average, about 10 percent year-over-year for the period. Over time, therefore, cloud deals have accounted for an increasing proportion of acquisitions and both the larger and fringe cloud providers remained active in acquiring cloud assets. However, the acquisitiveness of the top cloud providers varies significantly and appears to be unrelated to the provider’s business model. For example, Google Cloud leads with 27.4 percent of all cloud acquisitions, followed by IBM, with 20 percent, Microsoft Azure with 17.8 percent, and Oracle with 14.9 percent.

The cycle of cloud-related acquisitions reveals a significant ramp-up around 2002 that increased to a peak in 2015, and then begin to decline. The general pattern of cloud acquisitions generally mirrors that for total acquisitions by the top cloud providers. The DBE cloud providers were busy making other acquisitions, such as expanding in their platform markets and adding applications to their ecosystems. However, the cloud acquisition cycle appeared largely insulated from the significant economic downturn during the financial crisis of 2008 and which extended into the early 2010s.¹⁵

IV. WEAK MERGER ENFORCEMENT IN THE DIGITAL SECTOR

Within the last several years, U.S. merger enforcement in the digital sector has come under intense scrutiny, generating concern about acquisitions designed to extinguish smaller rivals and protect a dominant market position.¹⁶ This has prompted, among other responses, calls for stronger

¹³ See AAI Report, *supra* note 2, at 5. See also *Non-HSR Reported Acquisitions by Select Technology Platforms, 2010-2019: An FTC Study*, FED. TRADE COMM’N. (Sep. 15, 2021), <https://www.ftc.gov/system/files/documents/reports/non-hsr-reported-acquisitions-select-technology-platforms-2010-2019-ftc-study/p201201technologyplatformstudy2021.pdf>.

¹⁴ See AAI Report, *supra* note 2, at 8.

¹⁵ *COVID-19: Impact on US M&A Market*, ARANCA (Apr. 23, 2020), <https://www.aranca.com/knowledge-library/articles/investment-research/covid-19-impact-on-us-m-a-market>.

¹⁶ See e.g. *FTC v. Facebook Inc.*, Complaint for Injunctive and Other Equitable Relief, Case No.: 1:20-cv-03590 (Jan. 13, 2021, D.D.C.).

merger enforcement¹⁷ and proposals for new presumptions around acquisitions of potential competitors.¹⁸ However, the data does not reveal an improvement in the vigor of merger enforcement in the digital sector.

There has been extensive analysis of DOJ and FTC enforcement data on the rates of clearances, second requests, and challenges in the digital sector for the largest digital business ecosystems. This analysis reveals that between 2001-2017, the rates of clearances and second requests — or early stage reviews — were above average for all sectors.¹⁹ However, the rate of merger challenges was only 3 percent, far below the 13 percent average challenge rate across all sectors. The same analysis, with two more years of enforcement data (i.e. 2001-2019) revealed an even wider gap between the rate of merger challenges in digital (2.5 percent) and the rate of challenges across all sectors (15 percent).²⁰

The same analysis of enforcement data from 2001-2021 in the AAI Report concludes that the rate of clearance for digital deals has increased and that the rate of second requests remains higher than average relative to all sectors. But the rate of merger challenges in digital fell even further, to 2 percent, relative to the all-sector average of 15 percent, the widest gap observed thus far.²¹ Recent merger enforcement actions that will appear in future HSR data will shed more light on how enforcement in the digital sector is evolving. This includes the FTC's challenges of Meta's acquisition of virtual reality fitness app rival Within²² and Microsoft's acquisition of gaming giant Activision Blizzard.²³

V. MAJOR TAKEAWAYS FROM THE ANALYSIS OF CLOUD MARKET EVOLUTION AND STRUCTURE

The foregoing analysis of the evolution and structural features of the cloud technology market highlights a number of major observations. First, cloud technology players has grown rapidly, through acquisition and organically, but without triggering any substantive competitive enforcement response. The steady, upward trajectory of acquisition by the major cloud providers, especially from the early 2000s through 2015, is likely accounted for by the explosive growth of the digital sector more generally. This has largely occurred through acquisition.²⁴ Another factor is the drive to catch up with large cloud players, such as AWS, that have engaged primarily in organic growth. That said, the massive buildout of cloud technology has likely matured and the next cycle will be influenced far more by newer factors, such as competition enforcement and regulation in the digital sector.

Second, there appears to be stagnation in the structure of the cloud technology market that appears out of sync with the inherent dynamism of cloud technology. While there has been tremendous growth in the cloud market over time, the rank order of top cloud providers has not changed materially and the fringe players remain small. To be sure, narrower definitions of cloud technology markets could produce different market structures and levels of concentration. Nevertheless, the static structure of the larger cloud market has important implications. For example, it leaves little prospect of smaller players gaining a firmer foothold any time soon or a reshuffling of market shares among the top three players. Perhaps more important, this static market structure and three firm grasp on 65 percent of the market could create a barrier to new firm entry.

Third, the “acquisitiveness” of major cloud providers has little to do with their position in the cloud market. Among other things, this highlights the inherent tension between acquisitive and organic growth in expansion of the cloud technology market. For example, Google Cloud,

17 See e.g. Diana L. Moss, *Letter from AAI to Honorable Makan Delrahim re: Antitrust Review of Google's Acquisition of Data Analytics and Business Intelligence Startup Looker*, AMERICAN ANTITRUST INSTITUTE 1, 3 (July 8, 2019), https://www.antitrustinstitute.org/wp-content/uploads/2019/07/AAI-Ltr-to-DOJ_Google-Looker_7.8.19.pdf.

18 See e.g. C. Scott Hemphill & Tim Wu, *Nascent Competitors*, 168 U. Pa. L. Rev. 1879 (2020), https://scholarship.law.columbia.edu/faculty_scholarship/2661.

19 *The Weak Record of Merger Enforcement in Big Tech*, AMERICAN ANTITRUST INSTITUTE (Jul. 8, 2019), https://www.antitrustinstitute.org/wp-content/uploads/2019/07/Merger-Enforcement_Big-Tech_7.8.19.pdf.

20 *Update on Digital Technology: The Failure of Merger Enforcement and Need for Reform*, AMERICAN ANTITRUST INSTITUTE (Mar. 3, 2021), https://www.antitrustinstitute.org/wp-content/uploads/2021/03/Merger-Enforcement_Big-Tech_3.3.21_F.pdf.

21 AAI Report, *supra* note 2, at 12.

22 *FTC v. Meta Platforms, Inc., et al.*, Complaint For a Temporary Restraining Order and Preliminary Injunction, Case 3:22-cv-04325 (Jul. 27, 22, N.D. Cal.)

23 *In the Matter of Microsoft Corp. and Activision Blizzard, Inc.*, Federal Trade Commission, Docket No. 9412 (Dec. 8, 2022), https://www.ftc.gov/system/files/ftc_gov/pdf/D09412MicrosoftActivisionAdministrativeComplaintPublicVersionFinal.pdf.

24 See Diana L. Moss and David Hummel, *Anticipating the Next Generation of Powerful Digital Players: Implications for Competition Policy*, AMERICAN ANTITRUST INSTITUTE (Jan. 18, 2022), <https://www.antitrustinstitute.org/work-product/new-aaai-analysis-unpacks-acquisitive-growth-by-digital-firms-warns-of-next-wave-of-expansion-and-need-for-sector-wide-approach-to-competition-policy/>.

which has been the most acquisitive in cloud still remains in third place with 10 percent of the cloud market. IBM is the next most acquisitive but with only a 3 percent cloud market share. AWS presents the starkest example, with only 6 percent of cloud acquisitions but a 32 percent of the market. This strongly supports industry observations that AWS has added cloud functionality largely through organic growth.²⁵

VI. IMPLICATIONS FOR COMPETITION ENFORCEMENT AND POLICY

The foregoing analysis of the cloud technology market has important implications for competition enforcement and policy. First, we cannot help but ask if consolidation in cloud technology over the last 25 years may have evolved differently with stronger merger control. It is not the role of merger control to determine how companies make “buy or build” decisions around expansion and growth, or to pick winners and losers. However, a hands-off approach to merger control in the digital sector does appear to be an implicit endorsement of acquisition strategies by some cloud providers to keep-up or catch-up with players that have grown organically.

Second, the extent to which weak merger control in cloud has contributed to structural market stagnation and a persistent bifurcation of the market between the largest players and fringe warrants further study. For example, had merger enforcement been more systematic and vigorous, players may have opted to invest more resources in organic growth or to frame acquisition strategies that complemented organic growth. If so, the nature of competition between the largest DBE cloud providers could well have evolved differently, with more focus on innovation and less on acquiring smaller rivals that were perceived as a threat. This supports the notion that acquisition strategies geared toward catching up with larger players may themselves represent conduct designed to solidify or advance a market position.

Third, the incentives of major DBE cloud providers to exercise market power are determined by the integration of platform, cloud, and applications technologies that uniquely defines the business model. This opens the door to potentially more complex and less detectable anticompetitive conduct designed to leverage positions in cloud to other parts of an ecosystem. That the non-DBE cloud providers do not share these features will undoubtedly complicate the analysis of competition problems in cloud technology markets in both merger and conduct cases. Antitrust enforcers should, therefore, continue to pursue vigorous merger enforcement, at the same time they look carefully to identify competitive concerns around strategic conduct that could potentially hamper competition in cloud technology.

²⁵ Alex Hickey, *Build vs. buy: How AWS balances organic growth and strategic acquisitions*, CIODIVE (Jan. 18, 2019), <https://www.ciodive.com/news/aws-amazon-cloudendure-tso-logic-backup-acquisition/546417/> (noting that “with few acquisitions, the cloud leader tends to rely on organic growth of new functionalities”); See also Chetan Woodun, *Amazon’s AWS Growth Strategy Is Probably More Sustainable Than Oracle’s*, SEEKING ALPHA (Jan. 03, 2023, 6:37 PM), <https://seekingalpha.com/article/4567646-amazons-aws-growth-strategy-is-probably-more-sustainable-than-oracles>.



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