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Not "Big is Bad" but "Closed is Bad"? Exploring Dynamic Competition in Generative AI*

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ABSTRACT: Scholars have seized upon studies on economic concentration to revive the idea that "big is bad". A recent addition to the literature, by James Bessen, shares a concern for declining disruption rates but argues instead that "closed is bad". We review this debate, concluding that neither fully grapples with the dynamic competition paradigm. The theory of dynamic competition offers important nuances to current understandings of competition, and in particular the role of innovation, which we illustrate via a case study of generative AI. We then turn to policy measures, and in particular those under the "unbundling" umbrella, i.e., breaking ties, mandating interoperability, and imposing data sharing. Each of these measures is finding its way into the EU policy framework. We show that, though such measures can make sense in specific circumstances, the challenges – both conceptual and practical – are not to be underestimated. We build on our generative AI case study to highlight the opportunities and risks involved, which confirm the desirability of a case-specific approach.

KEYWORDS: dynamic competition; antitrust; innovation; unbundling; Artificial Intelligence

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1. Introduction

Over the last few years, scholars have warned about increasing concentration across the economy. While there is some agreement – though certainly not consensus[1] – on the increase in concentration, scholars disagree on important points: What explains rising concentration? What are its effects? And what – if anything – should the policy response be? Given that the extensive literature on these questions has been reviewed at length by others, we do not seek to redo that exercise[2]. Instead, we start from a recent but perhaps under-highlighted contribution: *The New Goliaths* by James Bessen[3].

Bessen's work provides a good starting point for different reasons. First, his book provides fresh answers to the above questions. Bessen argues that across industries, particularly in the U.S., leading firms have achieved and sustained their dominance through investments in proprietary software. Smaller firms have neither the means nor capabilities to keep up with such investment. The result is a slowdown in innovation. To reverse this trend, Bessen suggests opening up proprietary software ("unbundling"). Along the way, Bessen makes the case that the very nature of competition has changed: firms now compete on complexity. This argument provides a good opening to discuss changing conceptions of competition, with one conception – that of dynamic competition – deserving special attention. Finally, Bessen's proposed solution is aligned with current EU regulation of digital markets, which includes key unbundling measures. As such, his work invites a more fundamental assessment of digital openness mandates.

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[1] For a critical take, see Brian Albrecht, "Is market concentration actually rising?", 2022, *Truth on the Market*, https://truthonthemarket.com/2022/12/14/is-market-concentration-actually-rising/.

[2] For book-length treatments, see Thomas Philippon, *The great reversal: How America gave up on free markets* (Cambridge, MA: Belknap Press, 2019), Jonathan Baker, *The antitrust paradigm: Restoring a competitive economy* (Cambridge: Harvard University Press, 2019) and Jan Eeckhout, *The profit paradox: How thriving firms threaten the future of work* (Princeton: Princeton University Press, 2021).

[3] James Bessen, *The new Goliaths: How corporations use software to dominate industries, kill innovation, and undermine regulation* (New Haven: Yale University Press, 2022). Taking a book as an article's starting point is an uncommon but not untested method. For example, one of the best works on generativity (the internet's capacity to reinvent itself) has been written in the form of a book review, see James Grimmelmann and Paul Ohm, "Dr. Generative or: How I learned to stop worrying and love the Iphone", *Maryland Law Review* 69, no. 4 (January 1, 2010): 910, https://digitalcommons.law.umaryland.edu/mlr/vol69/iss4/5, which reviews Jonathan Zittrain, *the future of the Internet and how to stop it* (New Haven: Yale University Press, 2008).

Our main research question is whether/under which circumstances opening up propriety software is a sound policy choice. Any answer to that question must, however, start from a specific conception of competition. Therefore, our article is structured as follows. Section 2 reviews *The New Goliaths*, contextualizing it within the wider literature where relevant[4]. This provides an effective way to present the state of the art on contemporary competition and some of its discontents. Section 3 examines the different conceptions of competition that undergird policy debates. Bessen suggests firms now compete on complexity, but we put forward an alternative conception – that of dynamic competition. Though scholars have been shaping the dynamic competition paradigm for decades, it is still given short thrift in debates on the nature of competition. We help remedy this oversight through a theoretical treatment of dynamic competition, which we illustrate with a case study of generative artificial intelligence (AI). Section 4 zooms in on three specific unbundling measures that have become key parts of the EU regulatory agenda: undoing tying, mandating interoperability, and imposing data sharing obligations[5]. We examine the pros and cons of each measure building on our case study of generative AI.

2. Superstars: Complex Competition, Complex Regulation

In this section, we review Bessen's *The New Goliaths*, along with related literature. We are especially attentive to the argument that investments in proprietary software change the nature of competition, with complexity becoming one of the main parameters. Complexity competition, and the superstar firms it leads to, require competition policy to adapt. Section 2.1 discusses the changing nature of competition and its negative side effects. Section 2.2 reviews Bessen's view on how to regulate such competition to alleviate those effects.

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[4] Our review is based both on the book and on an interview we conducted with the author. The goal of the interview, conducted via Zoom on 30 January 2023, was to clarify some of the book's points and to apply its arguments to current competition policy debates.

[5] We focus on the EU as it is at the forefront of digital regulation. Other jurisdictions have also adopted or are considering unbundling measures. For example, South Korea has unbundled app distribution from app payment processing, while cases in the U.S. seek the radical unbundling solution of structural separation. Nevertheless, the EU stands out due to the maturity and coherence of its (unbundling) framework.

2.1. Complexity Competition and its Discontents

Bessen's main claim is that the investment of leading firms in proprietary software[6] has transformed the nature of competition. In turn, competing on complexity has changed the nature of markets, resulting in a new industry structure dominated by a few superstars[7]. This comes with negative side effects, in particular (i) a declining rate of disruption; (ii) the slower diffusion of technical knowledge; and (iii) a slowdown in productivity growth. Let us unpack this claim.

At the beginning of the digital revolution (say the 1970s to the 1990s), software levelled the playing field for small firms. Startups could rely on inexpensive computers and the flood of new software packages, which led to a general increase in industry dynamism[8]. However, the firms that succeeded at that initial point have meanwhile become superstars in their respective, increasingly concentrated markets. The secret to the success of these superstars is that they were able to "combine the advantages of large scale with the advantages of mass customization"[9]. Economies of scale, often used to explain competitive advantage, are no longer enough; the ability to differentiate the quality of their offering is what makes all the difference. In other words, it is the ability to "address [the] highly heterogeneous and sometimes rapidly changing demands of their customers" that provides superstars with a competitive advantage[10].

Competition based "on quality and features" is not new[11]. The novelty resides in the speed and degree to which proprietary software enables superstars to develop interconnected and highly dynamic sequential innovations. Superstars rely on the modular nature of their technology to offer, at greatly reduced (marginal) cost, products or services that become "highly complex, involving large numbers of features that require large initial fixed costs that rivals cannot profitably duplicate"[12]. The resulting

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[6] Bessen uses the term proprietary software broadly, as "the software code, data, and organization that provide [a] competitive advantage, and this may include cases where the software itself is open sourced". What makes the software proprietary is that "at least some critical part is not available to rivals and thus helps to differentiate the firm" (e.g., the software may be open-source but the data kept secret). See Bessen, *The new Goliaths*, 30.

[7] Earlier, see David Autor et al., "The fall of the labor share and the rise of superstar firms", *The Quarterly Journal of Economics* 135, no. 2 (May 1, 2020): 645.

[8] Bessen, *The new Goliaths*, 8-9.

[9] Bessen, *The new Goliaths*, 45.

[10] Bessen, *The new Goliaths*, xi.

[11] Bessen, *The new Goliaths*, 23.

[12] Bessen, *The new Goliaths*, 25.

market structure is one of "natural oligopoly", as described by John Sutton, where competition between differentiated firms is soft[13]. The structure of the market tends to remain stable over time, given that even as the size of a differentiated market increases, the payoff to qualify also increases[14].

In short, competing on complexity implies that firms differentiate themselves on quality[15]. This results in a natural oligopoly, in which – to stay ahead – firms need to make ever larger investments in R&D and advertising[16]. Note that, even though proprietary software is at the heart of this dynamic, complexity competition is in no way limited to digital markets. One of the recurring case studies is Walmart, an early adopter of the bar code technology. But Walmart really distinguished itself by building a new type of organization *around* the technology, allowing it to cost-effectively offer consumers a far greater selection of products.

Why does Bessen think this new form of competition – and the industry structure that comes with it – is a bad thing? He distinguishes three main issues[17]. Before diving in, note that Bessen's study concerns U.S. firms[18]. It distinguishes "top" or "leading" firms (ranked in the top four by sales in their industry) from "second-tier" firms (ranked fifth to eight) and other rivals[19].

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[13] Bessen, *The new Goliaths*, 47-48; See Avner Shaked and John Sutton, "Natural oligopolies", *Econometrica* 51, no. 5 (1983): 1469.

[14] "[T]he manufacture of aircraft, or mainframe computers, say, is limited to a small number of firms, not because the fixed costs of product development are so high, relative to the size of the market – but rather because the possibility exists, primarily through incurring additional fixed costs, of shifting the technological frontier constantly forward towards more sophisticated products". See Shaked and Sutton, "Product differentiation and industrial structure", *The Journal of Industrial Economics* 36, no. 2 (1987): 131.

[15] The exact definition of "competing on complexity" remains a bit elusive in the book; the closest description may be "to offer greater selection, more features, customized offerings, and/or greater targeting to better meet consumer needs", see Bessen, *The new Goliaths*, 21.

[16] "[W]hat matters is not the absolute size of the investment; what matters in this case is the size of investment relative to rivals' investments", see Bessen, *The new Goliaths*, 45-48.

[17] James Bessen et al., "Declining industrial disruption", *Boston University School of Law*, Faculty Scholarship, no. 20-28 (29 February 2020): 1.

[18] Since most of the top/leading firms occupy a similar position in the EU, the findings are at least partially transferable. Moreover, regulation tends to focus not on specific firms but types of firms (e.g., those of a certain size). Hence, findings on U.S. firms can help inform EU policy debates.

[19] Note also the differences with antitrust analysis, which starts from geographic and product markets rather than industries. The top four firms would not be dominant in antitrust terms (at most one of them would be), although – depending on other market characteristics – they might form an oligopoly.

First, the changing nature of competition has resulted in a declining rate of disruption. Bessen shows that today, "the likelihood that a top firm in any industry will be displaced by a rival is less than half of what it was in the late 1990s"[20]. When competing on complexity, it is the large investment required to produce a top-of-the-line product that limits competition[21]. Bessen illustrates this by reference to spreadsheet software. After a "feature war" that ran from the 1970s through to the 1990s, productivity software became so complex that very few firms could compete. Microsoft became the market leader in 1993, has kept the crown for the last 30 years, and "is unlikely to be disrupted anytime soon"[22]. The dynamic is this. Across industries, top firms invest more in proprietary software than second-tier firms[23]. This makes top firms grow faster, decreasing the likelihood that they will be leapfrogged and increasing their share of industry revenues[24]. Bessen argues that the link between software investment and industry concentration is causal, but as always, that is a difficult thing to prove[25]. Whatever the case may be, the problem is that, as the risk of displacement diminishes, top firms' incentive to innovate decreases. This is also true for second-tier firms (and other rivals): if they were to invest in greater quality, they would enter into more direct competition with the superstars, which is an unattractive prospect.

Second, and relatedly, superstars are keeping for themselves the technologies that provide them with a competitive edge. In the past, technological diffusion has been a central pillar of capitalism's success, and the

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[20] Bessen, *The new Goliaths*, 20.

[21] Bessen, *The new Goliaths*, 25.

[22] We note, however, that Microsoft's office software has been commoditized by Google's free offering on the lower end of the market; in the presentation segment, the design tool Canva appears to be on the rise. Bessen refers cars offer another example, with manufacturers leveraging complexity for competitive advantage. An average car model contains more than one hundred million lines of software code. And it is not even so much the sheer amount of code but rather the interaction among the various modules that heightens complexity. As a result, designing a new car from scratch costs as much as $5-6 billion, with software code alone accounting for $1 billion. See Bessen, *The new Goliaths*, 26-28.

[23] Since 1990, software investment by top firms doubled relative to the mean investments made by second-tier firms. This remains true excluding the software industry and other industries where software is a major part of the product. See Bessen, *The new Goliaths*, 31.

[24] Bessen, *The new Goliaths*, 32.

[25] In particular, Bessen rejects the weakening of U.S. antitrust enforcement since the 1980s as an explanation for the increase in industry concentration – for that argument, see, e.g., Philippon, *The great reversal*. While making some salient points, Bessen's rebuttal of that argument is not always as convincing. Bessen, *The new Goliaths*, 33-34.

move from an open to a closed system is a relatively recent development. There are two main ways for technology to diffuse: the first is "independent creation, including imitation, where rival firms can develop or acquire the knowledge and capabilities to implement a new technology"; the second is "voluntary diffusion, where firms that have the technology license or share that knowledge"[26]. Both methods of diffusion have suffered a dramatic slow-down in the last decades. First, the ever-increasing complexity and interconnectedness of proprietary software have made independent creation difficult. Second, top firms are no longer inclined to license their technology, because that "would undermine their degree of differentiation from rivals", threatening their leading positions[27]. Regulatory choices (e.g., employer-favouring IP laws and the acceptance of non-compete clauses) have further impeded the diffusion of technology. But it does not *have* to be this way. When General Motors (GM) invented the automatic transmission, for example, competitors invented alternative technologies *and* GM licensed the technology to Ford. The idea was that this innovation would expand the market, so even if GM got a smaller share of the pie, that pie would be much larger, translating into increased returns[28]. Today's superstars are more focused on their share of the pie – not the size of it.

Third, superstar industry dynamics are responsible for a decline in productivity growth. *Aggregate* productivity growth has declined, mainly because startup growth has slowed. It is not that startup formation has declined, or that these startups have less access to venture capital funding – a point on which Bessen explicitly disagrees with the U.S. Senate report on Big Tech[29]. Rather, the problem is that firms grow more slowly: "On average, a firm with a given productivity could be expected to grow only half as fast after 2000 compared to the 1980s and the 1990s"[30]. This statistic, which Bessen explains by reference to the technology gap, has at least two problematic implications. First, it ties in with disruption: when productive firms grow more slowly, they are less likely to leapfrog industry leaders and displace them. Second, small firms tend to do more product

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[26] Bessen, *The new Goliaths*, 55. The second method of diffusion also includes the movement of employees across companies and direct sales.

[27] Bessen, *The new Goliaths*, 57.

[28] Bessen, *The new Goliaths*, 53-54 and 67-68.

[29] Senate Judiciary Subcommittee on Antitrust, *Majority staff report of competition in digital markets*, 2020, https://democrats-judiciary.house.gov/uploadedfiles/competition_in_digital_markets.pdf.

[30] Bessen, *The new Goliaths*, 92.

innovation while large firms tend to do more process and incremental innovation – the slowdown means we are missing out on the former.

2.2. Regulating Complexity

After setting out the problem, Bessen turns to solutions. At the outset, he warns that regulating complexity is particularly difficult. The difficulty with regulating the software is that it requires access to the software code as well as the resources and expertise to interpret it. Take, for example, the scandal of Volkswagen's "Clean Diesel", which turned out to be not-so-clean[31]. The scandal hinged on "a small needle of code buried in a haystack of computer programs"[32]. The challenges of regulating complexity go beyond the fact that the products to be regulated are, well, complex. For one, the required technocratic approach to regulation comes with increased reliance on industry experts, which creates a risk of regulatory capture. Another consequence of regulatory complexity is "rising [compliance] costs that fall disproportionately on small firms, further boosting the dominance of large firms"[33]. Bessen suggests leveraging the power of the crowd. As Linus's law (named after Linus Torvalds of Linux fame) states: "Given enough eyeballs, all bugs are shallow"[34]. Similarly, involving both regulators and selected third parties in an "open-source-like review structure" could help mitigate the difficulty of regulating complexity[35].

Antitrust enforcement seems like a natural response given the book's focus on the persistent dominance of superstars[36]. But contrary to popular opinion, Bessen argues that the problem is not caused by weak antitrust enforcement or platform technology itself. Referencing the U.S. Senate report on Big Tech once more, he asks the difficult question: "Why would

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[31] Bessen, *The new Goliaths*, 123-124. Bessen studies two other case studies: the software in the Boeing 737 MAX that caused two plane crashes and subprime mortgages that helped cause the financial crisis.

[32] Bessen, *The new Goliaths*, 121. Another difficulty is that U.S. copyright law deems it illegal for anyone but the car manufacturers to access the code, see US Congress, Digital Millennium Copyright Act (Public Law No. 105-304), 28 October 1998, https://www.congress.gov/bill/105th-congress/house-bill/2281, Section 1021.

[33] Bessen, *The new Goliaths*, 137.

[34] The law was formulated by Eric Steven Raymond in his essay and later book, see Eric Steven Raymond, *The cathedral & the bazaar*, Revised ed. (United States: O'Reilly, 2001). Fittingly, one of the chapters is called "Many eyeballs tame complexity".

[35] Bessen, *The new Goliaths*, 139.

[36] Bessen dedicates chapter 9 (and 10, in part) to antitrust. The chapter is not all too focused as it spends the majority of its pages on well-trodden antitrust history.

the antitrust subcommittee, concerned about corporate dominance, instead go after companies that the public *likes*?". The focus on Big Tech is misguided: GAFA's combined domestic sales are less than 2% of the U.S. gross output whereas the top firms with proprietary technologies causing lower innovation and productivity cover 45% of the industries in the U.S. and 71% of the gross output[37]. To be clear, Bessen does believe dominant digital platforms deserve antitrust scrutiny. At the same time, he believes platform technology can be part of the solution. The role of antitrust policy "is not to break up platform businesses or turn them into public utilities but to encourage or compel more firms with proprietary technology to become open platform businesses"[38].

To understand this policy recommendation, let us take a step back. In Bessen's taxonomy (see figure below), platforms come in different varieties. One-sided platforms serve one user group, whereas multisided platforms facilitate interactions between different user groups. Closed platforms can only be used by the firms that developed them, whereas open platforms are accessible to the public.

	One-sided	*Multisided*
Closed	CAD systems; AWS before 2006	Walmart system for suppliers and store managers
Open	Amazon direct sales; AWS after 2006	Amazon Marketplace; Google advertising; AWS after 2012

Figure 1. Taxonomy of Platforms[39]

In short, Bessen argues that closed systems dampen competition whereas open platforms – especially of the multisided variety – promote competition[40]. Importantly, platforms can transition from closed to open, which

[37] Statistics mentioned during the OECD Productivity, Innovation and Entrepreneurship event "A discussion with James Bessen about his book 'The new Goliaths'", www.youtube.com/watch?v=hN364q2X38c.

[38] Bessen, *The new Goliaths*, 145-146.

[39] Figure reproduced from Bessen, *The new Goliaths*, 155. CAD stands for computer-aided design, AWS for Amazon Web Services.

[40] Arguably, the European Commission has enforced competition law from the opposite perspective, i.e., with a suspicion of open rather than closed systems. Framing that argument, see Nicolas Petit, "EU engaged in antitrust gerrymandering against Google", *The Hill*, 2018, https://thehill.com/opinion/technology/399742-eu-engaged-in-antitrust-gerrymandering-against-google/.

Bessen terms "unbundling" (a term familiar to antitrust lawyers). IBM, for example, unbundled its hardware from its software and services at the end of the 1960s[41]. While a government antitrust lawsuit gave IBM a push to do so, it was actually good for its business. With the growth of software and services, sales of its complementary hardware increased. Remember the pie mentioned earlier: "The reduced share of the pie was more than offset by the growth in the size of the pie"[42].

In Bessen's view, the firm "that excels at unbundling more than any other is Amazon"[43]. As indicated in the table above, Amazon unbundled both its cloud service (Amazon Web Services or AWS) and its e-commerce platform (Amazon Marketplace, including Fulfilment). Bessen does not deny the risk of anticompetitive conduct, such as the bundling of distribution with shipping, and self-preferencing, on Amazon Marketplace[44]. But he focuses on the fact that open two-sided markets can create new competition in highly concentrated markets. If that comes with predatory cross-subsidization, Bessen seems prepared to forgive such transgressions. He is, for example, willing to sweep allegations of below-cost pricing in shipping under the mat now that Amazon's logistics operation is disrupting the delivery market dominated by UPS and FedEx[45]. Of course, Amazon does not unbundle out of the goodness of its heart. In a dynamic that

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More generally on open vs. closed systems and the competitive implications, see Autorité de la concurrence and Competition & Markets Authority, *The economics of open and closed systems*, 2014, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/387718/The_economics_of_open_and_closed_systems.pdf.

[41] For a more in-depth look at the case, see Randal Picker, "The arc of monopoly: A case study in computing", *The University of Chicago Law Review* 87, no. 2 (May 4, 2020): 523.
David Autor et al., "The fall of the labor share and the rise of superstar firms", *The Quarterly Journal of Economics* 135, no. 2 (May 1, 2020): 645.

[42] Bessen, *The new Goliaths*, 168.

[43] Bessen, *The new Goliaths*, 170.

[44] Bessen, *The new Goliaths* 161; The European Commission recently adopted commitment decisions on both types of conduct, see European Commission, Decision of 20 December 2022, *Amazon/Buy Box*, C(2022) 9442 final.

[45] Bessen also discusses the Quidsi episode, in which Amazon undercut Diapers.com with potentially predatory prices (and finally acquired the firm). See Brad Stone, *The everything store Jeff Bezos and the age of Amazon* (London: Bantam, 2013), 361-367. Given that he also writes that predatory behaviour that restrains trade needs to be investigated, his stance seems somewhat ambiguous. The following statement seems to solve the apparent contradiction: "Given the economics of multisided platforms, one cannot assume that aggressive pricing leads to the elimination of competition, especially when the platform itself is open to third-party rivals". Bessen, *The new Goliaths*, 160.

should sound familiar by now, unbundling expands the market, growing Amazon's complimentary services to more than offset the sales it ends up losing to third parties.

When multisided platforms unbundle, the market expansion can be especially large due to network effects (or what Jeff Bezos calls "the Amazon flywheel"[46]). One would think this is a cause for concern, especially as Bessen argues that the economic environment complicates the antitrust assessment of conduct by multisided platforms. He also offers, however, that dominance such as that of Amazon comes "without some of the perverse effects of large proprietary software systems".[47] Openness is a form of technology diffusion, which is why Amazon delivers productivity growth for Marketplace sellers and facilitates disruption by startups using AWS. In short, "because the platforms have been opened up, they provide a powerful means for increasing industry dynamism"[48].

3. The Dynamic Competition Paradigm: A Case Study of Generative AI

Bessen is correct that it requires incredible investment to compete with today's superstars. To cite some numbers: Meta has invested around $50B in AR/VR with so far little return, Google lost $35B to become third in cloud, and Amazon poured over $40B in its Alexa voice assistant[49]. While these astronomical investment numbers are meaningful, they do not tell the full story. The dynamic competition paradigm paints a richer picture of competition, particularly in digital markets.

We start by introducing the ongoing competition in generative AI, including large language models (LLMs) (Section 3.1)[50]. Then, we turn to the dynamic competition paradigm, describing its essential aspects (Section 3.2). Finally, we return to Bessen's work to show how dynamic competition theory nuances current understandings of competition (Section 3.3).

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[46] For an explanation, see Ben Thompson, "The relentless Jeff Bezos", *Stratechery*, 2021, https://stratechery.com/2021/the-relentless-jeff-bezos/.

[47] Bessen, *The new Goliaths*, 177.

[48] Bessen, *The new Goliaths*, 177.

[49] Matthew Ball, "Big Tech's biggest bets (or what it takes to build a billion-user platform)", *MatthewBall.co*, 2023, https://www.matthewball.vc/all/bigtechbiggestbets.

[50] Note that this technology only showed its promise after the publication of *The New Goliaths*.

3.1. Introduction: Competition in Generative AI

The market leader in LLMs is OpenAI of ChatGPT fame. Microsoft alone has committed an investment totalling $13 billion in the startup[51]. On the one hand, this large investment illustrates how capital markets are still willing to fund competition to the leading tech platforms, which all have their own generative AI products (another example is Amazon, which is investing $4B in Anthropic – another generative AI competitor[52]). On the other hand, one main driver of competition is support by the leading platforms, meaning this is not the typical startup vs. incumbent story.

Then there is the disruption (not) brought by generative AI challengers like OpenAI[53]. Could generative AI disrupt Google Search's quasi-monopoly? Microsoft hopes so, as it integrated ChatGPT in Bing in a bid to win market share[54]. But significant market share gains were likely pre-empted when Google responded with its ChatGPT competitor Bard. In the end, neither firm may win the generative AI war. A leaked internal document from Google states:

> *[W]e aren't positioned to win this arms race and neither is OpenAI. While we've been squabbling, a third faction has been quietly eating our lunch. I'm talking, of course, about open source. (…) While our models still hold a slight edge in terms of quality, the gap is closing astonishingly quickly. Open-source models are faster, more customizable, more private, and pound-for-pound more capable. They are doing things with $100 and 13B params that we struggle with at $10M and 540B. And they are doing so in weeks, not months*[55].

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[51] Kyle Wiggers, "Microsoft invests billions more dollars in OpenAI, extends partnership", *TechCrunch*, 2023, https://techcrunch.com/2023/01/23/microsoft-invests-billions-more-dollars-in-openai-extends-partnership/. OpenAI CEO Sam Altman has suggested the company may try to raise as much as $100B.

[52] "Amazon and Anthropic announce strategic collaboration to advance generative AI", *Amazon*, 2023. https://www.aboutamazon.com/news/company-news/amazon-aws-anthropic-ai.

[53] On this topic, see perceptively Ben Thompson, "Google I/O and the coming AI battles", *Stratechery*, 2023, https://stratechery.com/2023/google-i-o-and-the-coming-ai-battles/.

[54] At least initially, Bing did receive a modest boost, see Akash Sriram et al., "OpenAI tech gives Microsoft's Bing a boost in search battle with Google", *Reuters*, 2023, https://www.reuters.com/technology/openai-tech-gives-microsofts-bing-boost-search-battle-with-google-2023-03-22/.

[55] You can read the leaked memo at Dylan Patel, "Google 'we have no moat, and neither does OpenAI'", *Semianalysis*, 2023, https://www.semianalysis.com/p/google-we-have-no-moat-and-neither.

Meta's approach to generative AI is in line with this assessment. It has open-sourced its LLaMa model[56]. Meta's chief AI scientist has predicted that "[t]he platform that will win will be the open one"[57]. Then again, open source has been hailed as a significant competitive force before without delivering on that promise. In desktop OS, Linux has been unable to capture more than a couple of percentage points of market share[58]. And open source does not diminish the point that complex products like computer OS require huge investment: in 2008 already, the cost of Linux – with its 204.5 million lines of code in 5547 application packages – was estimated to exceed $10B[59].

Time will tell whether the generative AI market becomes cornered by one or a few superstars. For now, some features are in line with Bessen's thesis (complexity requiring huge, incumbent-led investment), while other signs point in the opposite direction. In the remainder of this section, we discuss a framework that Bessen and others studying concentration do not always fully appreciate, that of dynamic competition, and apply it to the newest frontier of digital competition: generative AI.

3.2. Dynamic Competition Paradigm

For decades, academics have been theorizing a dynamic competition paradigm[60]. Such a paradigm brings necessary nuance to competing narratives.

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[56] See Hugo Touvron et al., "LLaMA: Open and efficient foundation language models", *Cornell University,* arXiv:2302.13971 (February 27, 2023).

[57] Cade Metz and Mike Isaac, "In battle over A.I., Meta decides to give away its crown jewels", *The New York Times*, 2023, https://www.nytimes.com/2023/05/18/technology/ai-meta-open-source.html.

[58] Statcounter puts it at 2.83% at the time of writing, see "Desktop operating system market share worldwide". *StatCounter Global Stats*, https://gs.statcounter.com/os-market-share/desktop/worldwide. Note, however, that the open-closed dichotomy is an oversimplification, see Irene Solaiman, "Generative AI systems aren't just open or closed source", *Wired*, 2023, https://www.wired.com/story/generative-ai-systems-arent-just-open-or-closed-source/.

[59] "Linux Foundation publishes study estimating the value of Linux", *Linux Foundation*, 2023, https://www.linuxfoundation.org/press/press-release/linux-foundation-publishes-study-estimating-the-value-of-linux.

[60] See, e.g., Thomas M Jorde and David J Teece, "Innovation, dynamic competition, and antitrust policy", *Cato Review of Business & Government* (Fall 1990): 35-44; Jerry Ellig, ed., *Dynamic competition and public policy: Technology, innovation, and antitrust issues* (Cambridge: Cambridge University Press, 2001); J. Gregory Sidak and David J. Teece, "Dynamic competition in antitrust law", *Journal of Competition Law & Economics* 5, no. 4 (December 1, 2009): 581-631; David J. Teece, "The Dynamic Competition paradigm: Insights and Implications", *Columbia Business Law Review* 2023, no. 1 (August 21, 2023): 374-461.

One narrative stresses how superstar firms are unavoidably entrenched. Another narrative holds that disruption always looms around the corner. Dynamic competition theory provides a more nuanced understanding.

Throughout history, one finds plenty of examples of large companies losing their previous competitive significance[61]. Those declines were often not due to competitors stealing their share *within* the relevant market, but rather due to technological innovation completely surpassing their market, drawing customers to a new market. Think of the diminishing use of horses-drawn carriages when motorised cars were invented; today, they are only used for tourist purposes in places like New York or Florence. Microsoft lost some of its dominance when its Windows operating system for PCs had to contend with the rise of the iPhone and other smartphones. Netflix's services took customers from DVD rental store, first by mailing DVDs and then by introducing streaming, causing Blockbuster to file for bankruptcy. Google certainly has these cautionary tales in mind when seeing users rely on ChatGPT for a question they would have otherwise asked Google.

These examples show the forces of dynamic competition at work. This type of competition incentivizes companies to think outside of the box, or relevant market, creating broad-spectrum competition[62]. Incumbents are not only in *actual* competition within their current market but also in *potential* competition with next-generation technology[63]. Firms able to respond may retain or even increase their share of the market. Those responses vary from new features, like Instagram introducing Reels to not lose relevance to TikTok, to more fundamental shifts, like Google Search having to respond to ChatGPT.

The dynamic competition paradigm is becoming more established. Recently, the OECD embraced the foundations for a dynamic competition

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[61] See Benedict Evans, "How to lose a monopoly: Microsoft, IBM and anti-trust", *Benedict Evans*, 2020, https://www.ben-evans.com/benedictevans/2020/01/01/microsoft-monopoly-and-dominance.

[62] Nicolas Petit and David J Teece, "Innovating Big Tech firms and competition policy: Favoring dynamic over static competition", *Industrial and Corporate Change* 30, no. 5 (December 31, 2021): 1169. Petit refers to this broad-spectrum competition as "moligopoly", see Nicolas Petit, *Big Tech and the digital Economy: The moligopoly scenario* (Oxford: Oxford University Press, 2020).

[63] David J. Teece, "Next-generation competition: New concepts for understanding how innovation shapes competition and policy in the digital economy", *Journal of Law, Economics & Policy* 9, no. 1 (2012): 97-118.

paradigm as laid out by Petit and Teece[64]. They view dynamic competition as rivalry for "future rents", as opposed to static competition for "existing rents"[65]. Static competition assumes competition takes place between existing products, leading to low prices. Absent the introduction of new products, markets are in stable equilibrium. Conversely, dynamic competition is characterised by the introduction of completely new or radically improved products. This understanding of competition does not seek equilibrium at a certain point but rather movements over time.

Both understandings of competition thus demonstrate a process of competition at work but with different drivers and outcomes: the process of static competition drives prices and quantities to equilibrium, whereas the process of dynamic competition propels innovation, taking markets out of equilibrium. The "static" in static competition can thus be understood as the attainment of a state of rest with optimizing firms. Conversely, the "dynamic" in dynamic competition implies an ongoing process of change driven by innovating firms, transforming existing markets or creating entirely new ones.

Currently, competition analysis is guided more by static than by dynamic assumptions[66]. Market definition, for example, identifies the products that exert competitive pressure on each other, first and foremost through a demand-side substitution analysis focused on *actual* substitutes[67]. However,

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[64] OECD Secretariat, "Competition and innovation, part I: A theoretical perspective", *Background note for the 140th meeting of the Competition Committee*, 2023, https://one.oecd.org/document/DAF/COMP(2023)2/en/pdf.

[65] Petit and Teece, "Innovating Big Tech firms and competition policy", 1170. For a more elaborate understanding of the two dimensions of competition, see Teece, "The dynamic competition paradigm", 382-389.

[66] Christopher Pleatsikas and David Teece, "The analysis of market definition and market power in the context of rapid innovation", *International Journal of Industrial Organization* 19 (2001): 665-693; Dennis W. Carlton and Robert H. Gertner, "Intellectual property, antitrust, and strategic behavior", *Innovation Policy and the Economy* 3 (2003): 29-59; Sidak and Teece, "Dynamic competition in antitrust law"; David S. Evans and Keith N. Hylton, "The lawful acquisition and exercise of monopoly power and its implications for the objectives of antitrust", *Competition Policy International* 4, no. 2 (2008): 203-241.

[67] See Commission Notice on the Definition of Relevant Market for the Purposes of Community Competition Law", OJ C372/5 § (1997), paragraph 24 on how potential competition is not taken into account when defining markets. An example of a case where an overly strong focus on actual substitutes might have affected the market definition analysis is *Google Shopping*, in which the Commission (and then General Court) excluded merchant platforms like Amazon.com from the relevant market, see European Commission, Decision of 27 June 2017, *Google Search (Shopping)*, C(2017) 4444 final; and Judgment of 10 November 2021, *Google and Alphabet v. Commission*,

product differentiation yielded by dynamic competition blurs these market boundaries because also products that may not be direct substitutes or are complements exert competitive pressure[68]. Accordingly, if the goal is to include all competitive constraints in the relevant market, in cases involving dynamic competition a broader perspective should be taken to also include non-substitutes. Promisingly, the draft of the Commission's new market definition notice is more forward-looking, as it accounts for expected transitions in the structure of a market when the case calls for a forward-looking assessment[69].

Another example is competition policy's structural approach to ensuring competitive markets, which rests on the (correct) premise that competition drives prices down. But competition also drives innovation[70] and, in turn, innovation drives competition[71]. Recall that dynamic competition refers to the competitive activities rendering change or responding to it. The recent introduction of Open AI's ChatGPT is an example of such change. The responding competitive activities include Google launching its own AI chatbot Bard[72], Amazon expanding partnerships with different AI startups[73], and Meta expressing its intention to "turbocharge" its

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EU:T:2021:763. Consumer surveys indicate that Amazon.com is more often used as a starting point to search for products, see, e.g., Jungle Scout, "Consumer trends report", *Jungle Scout*, 2023, https://www.junglescout.com/wp-content/uploads/2023/09/Jungle-Scout-Consumer-Trends-Report-Q3-2023.pdf.

[68] Ron Adner and Marvin Lieberman, "Disruption through complements", *Strategy Science* 6, no. 1 (March 2021): 91-109.

[69] "Draft Commission Notice on the Definition of the Relevant Market for the Purposes of Union Competition Law" (2022), paragraph 16, which further clarifies: "Structural market transitions differ from considerations relating to market entry by potential competitors ('potential competition') in that they affect the general dynamics of demand and supply in a market and therefore the general reactions to changes in relative supply conditions".

[70] The unresolved economic debate regarding the relation between market power and innovation is put aside here; for a summary, see Wolfgang Kerber, "Competition, innovation, and competition law: Dissecting the interplay", in *Dynamic markets and dynamic enforcement: The impact of the digital revolution and globalisation on the enforcement of competition law in Europe*, ed. Damien Gerard (Brussels: Bruylant, 2018), 33-62.

[71] Sidak and Teece call this the "innovation-cycle" at work, see Sidak and Teece, "Dynamic competition in antitrust law". See also William J. Abernathy and James M. Utterback, "Patterns of industrial innovation", *Technology Review* 80, no. 7 (1978): 1-9.

[72] Sundar Pichai, "Google AI updates: Bard and new AI features in Search", *Google Blog*, 2023, https://blog.google/technology/ai/bard-google-ai-search-updates/.

[73] Jeff Boudier, Philipp Schmid and Julien Simon, "Hugging Face and AWS partner to make AI more accessible", *Hugging Face*, 2023, https://huggingface.co/blog/aws-partnership.

products with AI[74]. A firm still needs an *incentive* to innovate, in OpenAI's case to develop a new product, but an incentive alone is not determinative for the innovation to take place. A company needs strong innovation *capabilities* to introduce innovation to the market. An assessment of incentives to innovate based on the numbers of competitors is thus not sufficient in ensuring competitive markets and should be supplemented by an internal assessment of a firm's innovation capabilities[75].

3.3. Dynamic Competition Nuances

Dynamic competition theory has been making strides. Nevertheless, it is not always fully appreciated in contemporary debates on the nature and state of competition in the (digital) economy. To show the degree of alignment and mismatch, we return to Bessen's *The New Goliaths*, analyzing how it fits with the dynamic competition paradigm. The goal is to show how a dynamic understanding of competition nuances other contemporary analyses. At the same time, dynamic competition theory is still taking shape and therefore open to lessons from recent work such as Bessen's. Our analysis focuses on three aspects: (i) the competition on complexity; (ii) the sources of dynamism; and (iii) the dynamic capabilities.

3.3.1. Competing on Complexity for Antitrust Purposes

Bessen refers to the competition that results in a few superstars as "competition on complexity". Note that complexity in this sense does not refer to complexity theory, which is commonly associated with dynamic competition[76]. Bessen's complexity refers to that of the offering. Firms continuously respond to changing consumer demands by adding features, versions, customisations and other variations, thereby increasing complexity. This competition constantly brings forward new generations of products that build on and improve previous ones, resulting in product differentiation and heterogeneity. Dynamic competition theory acknowledges that

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[74] Mark Zuckerberg's post on Facebook, 2023, https://ap.lc/yRMnC.

[75] Economists and lawyers have been advocating for a capabilities assessment in antitrust, see, e.g., Richard J. Gilbert and Steven C. Sunshine, "Incorporating dynamic efficiency concerns in merger analysis: The use of innovation markets", *Antitrust Law Journal* 63, no. 2 (1995): 569-601; Michael L. Katz and Howard A. Shelanski, "Mergers and innovation", *Antitrust Law Journal* 74, no. 1 (2007): 1-86; Sidak and Teece, "Dynamic competition in antitrust law"; Kerber, "Competition, innovation, and competition law".

[76] Nicolas Petit and Thibault Schrepel, "Complexity-minded antitrust", *Journal of Evolutionary Economics*, no. 33 (2023): 541-570.

competitive pressure not only comes from substitute products but also from next-generation technology with (seemingly) different characteristics.

One dimension of dynamic competition is, however, not covered. Competition on complexity suggests that competition drives innovation, but dynamic competition theory also suggests that innovation drives competition. In dynamic markets, innovative products are introduced to which firms respond by innovating, as seen in the case study of generative AI. Of course, firms need advanced technologies to innovate. Think, in the context of generative AI, of the immense resources (in the form of chips and cloud computing) required to train ever-larger LLMs. If these technologies are only available to a few superstars, change can only be caused by a few, and less subsequent competition can be expected. In short, competition on complexity is not an all-encompassing concept, but it does put a useful focus on innovation capabilities.

3.3.2. Sources of Dynamism

Competing on complexity requires increasingly advanced technologies, Bessen argues. As only top firms possess these technologies and keep them proprietary, small competitors fall behind, decreasing the disruption rate and industry dynamism. The evidence puts Schumpeter's and Christensen's work on disruption – important theories in dynamic competition theory – in perspective[77]. At the same time, Bessen's argument overlooks or does not attach enough importance to certain sources of dynamism.

First, dynamism is not limited to disruptive innovation but is also caused by incremental, sequential or sustaining innovation, which Bessen gives short shrift in the book[78]. In our interview, Bessen did clarify that the productivity benefits from innovation mostly come from incremental improvements following the initial innovation. Still, he considers the decline in disruption a bellwether for an innovative system that is not working as it should be. Especially in the context of complexity competition, where new product variations build on previous generations, one can question whether disruption is a precondition for dynamism. Moreover, it

[77] Joseph A. Schumpeter, *Capitalism, socialism and democracy* (Georgetown: Routledge, 2015 [1942]); Clayton M. Christensen, *The innovator's dilemma: When new technologies cause great firms to fail* (Boston, Mass: Harvard Business School Press, 1997).

[78] Christensen already observed and warned for the overuse of disruptive innovation. See Clayton M. Christensen et al., "Disruptive innovation: An intellectual history and directions for future research", *Journal of Management Studies* 55, no. 7 (2018): 1043-1078.

is difficult to categorize innovation. Take generative AI: is this a disruptive or sustaining innovation? The jury is still out, but it could very well be the latter[79]. In any case, underestimating the significance of incremental innovation can result in overlooking an essential source of dynamism.

Second, Bessen measures industry dynamism through the turnover rate of dominant firms, i.e., how often dominant firms get displaced by up-and-coming firms[80]. But industries are not only dynamic when dominant firms are displaced regularly. Digital markets are characterised by a few firms with high, fairly stable market shares, yet they remain innovative and subject to change[81]. We have used the example of the search market being recently upended by OpenAI to illustrate this. ChatGPT posed a competitive threat that pushed Microsoft and Google to respectively incorporate and launch their own versions[82]. This shows how, even without eventual displacement, challengers can incentivize incumbents to innovate.

Third and relatedly, the measurement of sector dynamism is only concerned with up-and-coming firms, thereby overlooking competitive pressure from incumbents. But industry dynamism can also be driven by incumbents, at least when they continue to compete against each other. The generative AI war shows both sources of dynamism. First, Microsoft was outdone by the much smaller OpenAI[83]. It subsequently invested,

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[79] Ben Thompson believes generative AI to be a sustaining innovation, see Ben Thompson, "AI and the Big Five", *Stratechery*, 2023, https://stratechery.com/2023/ai-and-the-big-five/ (quoting Christensen for his definition of "sustaining innovation": "Most new technologies foster improved product performance. I call these sustaining technologies").

[80] Bessen, *The new Goliaths*, 8-9. While Bessen uses the term dominance, his empirical work relies on measurements that do not relate directly to market power (in particular whether a firm qualifies as top four by sales in an industry).

[81] For an overview of Big Tech and dynamic competition, see David J. Teece, "Big Tech and strategic management: How management scholars can inform competition policy", *Academy of Management Perspectives* 37, no. 1 (2023): 1-15. Bessen does acknowledge that "the evidence does not support the conclusion that a greater role for large firms automatically means less innovation". Bessen, *The new Goliaths*, 94.

[82] Microsoft, a very distant second in search, would qualify as one of Bessen's top firms. Should Microsoft displace Google as the search incumbent, which is unlikely, this would not count as displacement according to Bessen's methodology.

[83] Microsoft CEO Satya Nadella recognized this at the time of the first investment in 2019 and continues to do so. Having seen ChatGPT-4, he reportedly said: "OpenAI built this with 250 people (…) Why do we have [the 1,500-person strong] Microsoft Research at all?", see Aaron Holmes, "How Microsoft swallowed its pride to make a massive bet on OpenAI", *The Information*, 2023, https://www.theinformation.com/articles/how-microsoft-swallowed-its-pride-to-make-a-massive-bet-on-openai.

providing OpenAI with its essential cloud capabilities. The Microsoft-OpenAI partnership then put Google on the defensive[84]. In other words, even current superstars continue to leverage their capabilities to move into new spaces, and those moves keep their competitors on their toes.

To sum up, dynamism is not limited to disruptive innovation, the displacement of dominant firms, and competitive pressure from startups. It is also driven by incremental innovation, the *potential* of displacement, and competitive pressure from incumbents.

3.3.3. Dynamic Capabilities

Dynamic competition theory hinges strongly on dynamic capabilities in explaining why some firms and not others are capable of outperforming competitors[85]. These capabilities enable them to quickly respond to changes in their environment through innovation. The capabilities involve the sensing of opportunities and threats, seizing or defusing them, and continuously transforming systems and processes[86]. Bessen stresses a limitation to this capabilities framework: the lack of access to proprietary software may not prevent startups from entering but can prevent them from growing. Start-ups can detect opportunities in the competition for complexity but may struggle to fully seize them due to the lack of capabilities to manage increasing complexity. Along these lines, Microsoft's investment in OpenAI consists, amongst others, of "the development and deployment of specialized supercomputing systems to accelerate OpenAI's groundbreaking independent AI research"[87]. Bessen's argument shows that the story does not end with capabilities or, alternatively, puts the spotlight on

[84] See Ben Thompson, "New Bing, and an interview with Kevin Scott and Sam Altman about the Microsoft-OpenAI partnership," *Stratechery*, 2023, https://stratechery.com/2023/new-bing-and-an-interview-with-kevin-scott-and-sam-altman-about-the-microsoft-openai-partnership/, in which OpenAI's Sam Altman describes the partnership with Microsoft as challenging Google's "lethargic search monopoly".

[85] Teece, "Big Tech and strategic management".

[86] David J. Teece, "Reflections on 'profiting from innovation'", *Research Policy* 35, no. 8, (2006): 1144; David J. Teece, "The foundations of enterprise performance: Dynamic and ordinary capabilities in an (economic) theory of firms", *Academy of Management Perspectives* 28, no. 4 (2014): 333, 335; David J. Teece, "Dynamic capabilities and entrepreneurial management in large organizations: Toward a theory of the (entrepreneurial) firm", *European Economic Review*, 86 (2016): 208, 211.

[87] "Microsoft and OpenAI extend partnership", *The Official Microsoft Blog*, 2023, https://blogs.microsoft.com/blog/2023/01/23/microsoftandopenaiextendpartnership/.

proprietary software as one source of such capabilities – a useful addition to theories of dynamic competition.

3.3.4. Solution of Open Technology (Unbundling)

Bessen's proposed solution is for firms with proprietary technology to open it up, in some form and to some degree, to other companies (unbundling). In our interview, Bessen emphasized that this solution is not meant to punish successful companies that have grown dominant but to create a win-win situation. The examples of IBM and Amazon show that not only can smaller competitors benefit from the technologies, but incumbents *themselves* can also benefit from an increase in total demand (they receive a smaller share of a bigger pie). Incumbents can gain an additional income stream from companies using their software, and even benefit from improvements and tools contributed by these new users to their software. This is precisely the rationale behind Meta's decision to open up its AI infrastructure[88].

From a dynamic competition perspective, opening proprietary technologies can have positive results. Innovative start-ups that manage to enter can use the technologies to compete on complexity, introduce new features and challenge incumbents. This, in turn, boosts industry dynamism and spurs innovation. Providing these start-ups with access to advanced technologies certainly does not guarantee their success in the competition on complexity. The start-ups still need strong dynamic capabilities and innovation excellence to stay competitive in the long-run. To build on Bessen's Goliath metaphor: the proprietary technologies are analogous to David's sling: they provide a *chance* to fight the giants. It then comes down to competition to select the winner.

At the same time, one must be careful when opening up previously closed systems, for several reasons. First, opening up such a system, which often comes down to sharing it, can interfere with the property rights of the system operator. Second, a sharing obligation can affect incentives to invest: the system operator and others like it will be less motivated to build a system when they then have to share it; those making use of the incumbent's system will not be incentivized to compete by building their own. Third, defining sharing obligations, e.g., in the form of an antitrust

[88] "Meta – Meta reports first quarter 2023 results", *Meta Investor Relations*, 2023, https://investor.fb.com/investor-news/press-release-details/2023/Meta-Reports-First-Quarter-2023-Results/default.aspx.

remedy, can be difficult: in digital markets, it can require engaging deeply with complex product design and business model choices, and in any case, it requires setting access conditions at the right level[89]. Despite the foregoing words of caution, we believe there is room for well-calibrated unbundling measures. In the next section, we discuss those within the EU policy framework.

4. Policy Lessons: EU Unbundling Measures

Unbundling measures have grown in popularity in the EU's competition policy toolbox. We understand "competition policy" broadly, as encompassing not only competition law but also the Digital Markets Act (DMA)[90] and other regulation focused at least in part on issues of competition (e.g., the Data Act). Note, however, that unlike competition law, specific regulatory instruments may apply only to a subset of firms. The DMA, for example, is set to apply to six firms (Google [Alphabet], Apple, Facebook [Meta], Amazon, Microsoft, ByteDance)[91].

Within this field, we distinguish three categories of unbundling measures[92]. The first, most tested unbundling measure is the undoing of ties, traditionally through competition law. A second unbundling measure, which has been imposed both through competition law and sectoral regulation, is interoperability. Even more clearly than other measures, interoperability requires a firm to open up its systems. A third and final unbundling

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[89] On this point, the methodologies developed to calculate FRAND (fair, reasonable and non-discriminatory) rates provide guidance, see Anne Layne-Farrar and Koren W. Wong-Ervin, "Methodologies for calculating FRAND damages: An economic and comparative analysis of the case law from China, the European Union, India, and the United States", *Jindal Global Law Review* 8, no. 2 (October 1, 2017): 127-160.

[90] Regulation (EU) 2022/1925 of the European Parliament and of the Council of 14 September 2022 on Contestable and Fair Markets in the Digital Sector and Amending Directives (EU) 2019/1937 and (EU) 2020/1828, OJ L265/1 § (2022) (hereafter: DMA). The DMA's goals of fairness and contestability are said to be complementary to competition law's goal of undistorted competition, but the two bodies of law also show overlap.

[91] The DMA, for example, only applies to so-called "gatekeepers", which have recently been designated for the first time, see European Commission, "Digital Markets Act: Commission designates six gatekeepers", *Press Release*, 2023, https://ec.europa.eu/commission/presscorner/detail/en/ip_23_4328.

[92] There are other measures that can be seen as "unbundling", such structural divestitures, functional separations, access obligations (of which data sharing are a specification), and non-discrimination requirements. We choose to focus on untying, data sharing, and interoperability as these measure are most relevant when it come to proprietary software and as they feature most prominently in EU competition policy.

measure is mandatory data sharing. Below, we discuss each policy measure in turn, weighing the pros and cons and illustrating them by reference to generative AI.

4.1. Tying

In antitrust parlance, unbundling immediately brings to mind breaking ties – one of the most traditional interventions. Bessen, for example, spills a lot of ink on a case study of Nuance, a firm making speech recognition software[93]. The firm grew significantly from 2005 to 2014 as Apple used the Nuance engine to power Siri, and Android apps widely used it for dictation and related tasks. Over time, however, the large platforms realized voice may be an essential part of their developing ecosystems. Apple brought its recognition technology in-house. Google went further and obliged phone makers to use its full suite of Android apps. This meant giving Google control of the microphone for many tasks, which led phone makers to no longer preinstall Nuance's technology. Nuance ended up pivoting to the niche market of healthcare and was acquired by Microsoft in a $16B transaction that was approved by the European Commission[94].

This scenario is familiar to EU competition lawyers. Replace speech recognition by search and internet browsing and you are essentially describing the *Google Android* case[95]. That case is even more instructive. Google went from an open system (the open-source Android OS) to a more closed system by bundling its suite of apps together. This "open early, closed late" strategy clearly runs counter to an unbundling policy. But here is the issue: prohibiting any bundling, especially in digital markets where it can engender significant efficiencies, would be harmful. A case-by-case analysis, which can duly weigh the anticompetitive effects against justifications (e.g., the prevention of free-riding or the consumer demand for an "out of the box" experience), is called for. The European Commission has been

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[93] Bessen, *The new Goliaths*, 83-89 and 102-103.

[94] European Commission, Decision of 21 December 2021, Microsoft/Nuance, C(2021) 9923 final.

[95] European Commission, Decision of 18 July 2021, Google Android, C(2018) 4761 final. When Bessen writes that "antitrust authorities might well have prevented Google from reducing Nuance's access to Android users" (Bessen, *The New Goliaths*, 103), the lack of a reference to *Google Android* seems like an omission. Instead, Bessen references Ron Amadeo, "New Android OEM licensing terms leak: 'Open' comes with a lot of restrictions", *Ars Technica*, 2014, https://arstechnica.com/gadgets/2014/02/new-android-oem-licensing-terms-leak-open-comes-with-restrictions/.

carrying out effects analyses of tying in platform markets since *Microsoft I* [96] and is now poised to do so again in its *Microsoft Teams* investigation[97].

The DMA goes a step further. Inspired by the remedies in earlier cases such as *Microsoft II*[98] and *Google Android*[99], it requires that operating systems prompt the user to freely choose their search engine, virtual assistant and web browser upon first usage[100]. The DMA considers this deviation from case-by-case analysis justified given its limited scope and the support in competition law precedent – at least when it comes to browsers and search engines. Nevertheless, completely barring procompetitive justifications makes the instrument liable to over-enforcement[101].

LLMs do not qualify neatly as any "core platform service" – a precondition to be designated as gatekeeper under the DMA[102]. Though they share some characteristics with search engines and virtual assistants (and even social networks)[103], they do not fit the definition of either[104]. But competition law continues to apply. Looking at the generative AI landscape, first movers have tried to tie services to their LLM so that the popularity of the latter could lift that of the former. Microsoft, for example, initially required users to download its Edge Browser to use Bing Chat, its generative AI chatbot powered by ChatGPT[105]. In the absence of dominance, however, Microsoft's business strategies are not to be condemned. Indeed, from a dynamic competition perspective, one even wants to promote such

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[96] European Commission, Decision of 24 March 2004, Microsoft, C(2004)900 final.

[97] European Commission, "Commission opens investigation of practices by Microsoft", *Press Release*, 2023, https://ec.europa.eu/commission/presscorner/detail/en/ip_23_3991.

[98] European Commission, Decision of 16 December 2009, Microsoft (tying).

[99] European Commission, Google Android.

[100] DMA, article 6(3).

[101] On this point, see Luís Cabral et al., "The EU Digital Markets Act: A report from a panel of economic experts", 2021, 10-11, https://publications.jrc.ec.europa.eu/repository/handle/JRC122910.

[102] See Peter Picht and Anna-Katharina Leitz, "Algorithms and competition law – Status and challenges", *SSRN* (2024), 20-21, https://ssrn.com/abstract=4716705.

[103] DMA, article 2(2), (6) and (12).

[104] This changes when the LLM is integrated into a core platform service, e.g., a search engine or virtual assistant, as a feature. In that case, they – or at least the services they form part of – do fall under the DMA's scope.

[105] See Tom Warren, "Microsoft's AI-powered Bing chat is coming to mobile browsers", *The Verge*, 2023, https://www.theverge.com/2023/8/7/23822773/microsoft-bing-ai-chat-mobile-browsers-google-chrome-safari. Identifying such conduct as a potential concern, see Competition & Markets Authority, "AI foundation models", *Initial Report*, 2023, paragraph 4.27, https://www.gov.uk/government/publications/ai-foundation-models-initial-report.

a challenger in the browser and search engine space, even if it might be dominant in other markets.

4.2. Interoperability

Vertical interoperability provides another unbundling measure: it implies opening up platform technology so that other firms can develop complements[106]. For an example of this evolution, consider the iPhone: it started out as a fully integrated system with every app being provided by Apple; soon thereafter, Apple unbundled by introducing the App Store, allow independent developers to build apps for its operating system iOS. Conversely, should Apple "rebundle", e.g., by excluding apps from its ecosystem, competition authorities should be on guard.

But the example throws up a more difficult question: what *degree* of unbundling is ideal? Should Apple also unbundle at a higher level, e.g., by allowing not just apps but also independent app stores within iOS[107]? Apple's software development kit (SDK) gives developers access to a set of application programming interfaces (APIs) to power their apps, but reserves others – e.g., near-field communication (NFC) – to itself. Should it also open up the NFC API, which would allow wallet app developers to offer "tap-and-go" payments in competition with Apple[108]? Both cases are now subject to competition enforcement, while the DMA bypasses such case-by-case analysis in favour of brightline rules on app store and API interoperability[109].

Neither Bessen, nor the DMA have a clear answer to the above question. Bessen lauds Apple for opening up iOS via its App Store and appears content to stop there. Of course, a walled garden is not exactly opened up by building one bridge into it, especially when that bridge it tightly controlled and can be pulled up at any time. The DMA goes further: it seems premised on the idea that more openness – indeed, near-absolute openness – is preferable. Apple has to allow other app stores, but also the side-loading

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[106] By contrast, horizontal interoperability implies opening up a network (e.g., messenger service) to substitutes (i.e., other messaging services). Such interoperability is mandated by DMA, article 7.

[107] This has been the subject of Epic's case, see Order of 10 September 2021, *Epic Games, Inc. v. Apple Inc.*, No. 4:20-cv-05640-YGR.

[108] This is the subject of an EU case, see European Commission, "Antitrust: Commission sends statement of objections to Apple over practices regarding Apple Pay", *Press Release*, 2022, https://ec.europa.eu/commission/presscorner/detail/en/IP_22_2764.

[109] See DMA, article 6(4) on app store interoperability and article 6(7) on interoperability with proprietary hardware and software features.

of apps; in addition, it must allow competing browsers to provide greater web app functionality; finally, it limits the rents Apple can extract from its App Store[110].

The "ideal" degree of openness likely lies somewhere in between. A facile answer to the question would therefore be that the degree of openness must be determined case-by-case. In a world of unlimited enforcement resources, that may be feasible. But it is exactly the enforcement reality of long, complex investigations with remedies of questionable effectiveness that led policymakers to adopt the DMA. Hence, it might be more useful to consider when one might transition from competition law enforcement to regulatory interoperability measures. From a dynamic competition perspective, mature markets (such as banking)[111] are certainly more amenable to regulation than younger ones. When a new technology disrupts a market, it is recommended to let that process play out while relying on competition law whenever a player tries to distort the process.

Another question relates to the *type* of interoperability imposed. The EU's Data Act refers to several of the existing types of interoperability, such as cloud interoperability, transport interoperability, syntactic interoperability, semantic data interoperability, behavioural interoperability and policy interoperability[112]. Different situations require different types of interoperability. In the context of generative AI systems, *each* type is relevant: cloud interoperability for models to operate across different cloud platforms; transport interoperability for models to conduct data transport protocols (i.e., for data exchanges to take place); syntactic interoperability for the data to be understood and processed by the model; semantic interoperability for the generation of human-like content; behavioural interoperability for different models to communicate with one another and give solutions to complex tasks; and policy interoperability for the generative AI systems to comply with different rules or protocols and the same time.

For now, many LLMs provide vertical interoperability, albeit to different degreees[113]. Models like that powering ChatGPT provide relatively limited interoperability. Third parties can send prompts and receive answers, paying for them on a metered basis. Firms can thus develop apps

[110] See, in addition to the articles referenced above, DMA, articles 5(4) and (7), and 6(12).

[111] See the discussion of data sharing in the financial sector discussed under the next section.

[112] Regulation (EU) 2023/2854 of 13 December 2023 on Harmonised Rules on Fair Access to and Use of Data, OJ L2023/2854 § (2023) (hereafter: Data Act), article 35(2).

[113] Competition & Markets Authority, "AI foundation models", paragraph 2.21.

("wrappers") around ChatGPT focusing on specific use cases. A higher degree of interoperability is provided by open-source models such as Meta's LLaMa, which third parties can fully deploy on their systems. Such product differentiation is welcome, though it is important that open models continue to exist – and do not become more closed. If all models become fully proprietary, customers and complementors can – given the prohibitive cost and capability requirements of building models – run into access issues. For now, threats relating to interoperability, while sometimes flagged as future concern, are not yet concrete. Therefore, a closely related measure – data sharing – is more important.

4.3. Data Sharing

Data sharing is a policy measure that relies on interoperability (especially transport interoperability) and facilitates the breaking of ties. A single data point by itself cannot be used for much, but large data sets are extremely valuable, especially in the software era. Think back, for example, to Bessen's case study of Walmart: its success was not only due to its software, but also to its customer data, which delivered actionable insights[114]. Google and Facebook offer "an unprecedented level of targeting" for advertisers, but this is only because of the huge amount of personal data they collect[115]. Potential competitors, even with the same software but no data, could not achieve the same results.

Encouraging firms to share data therefore seems like a common-sense policy. Reality shows, however, that firms do not necessarily have an incentive to share data. The EU already attempted to encourage enterprises to share non-personal data with the Free Flow of Non-Personal Data Regulation[116]. The failure of this voluntary framework[117] is what propelled the EU shift to creating compulsory data sharing frameworks under the

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[114] Bessen, *The new Goliaths*, 9.

[115] Bessen, *The new Goliaths*, 29.

[116] Regulation (EU) 2018/1807 of the European Parliament and of the Council of 14 November 2018 on a Framework for the Free Flow of Non-Personal Data in the European Union, OJ L303/59 § (2018). Reading the regulation, one guesses that Bessen would agree with the approach, as it establishes an "encouragement" and "facilitation" framework (without enforcement) for data sharing.

[117] The Commission considers that this has been an unsuccessful "self-regulatory approach to the problems of 'vendor lock-in' at the level of providers of data processing services", see European Commission, Explanatory Memorandum to the Proposed Data Act, COM(2022) 68 final, 4, https://digital-strategy.ec.europa.eu/en/library/data-act-proposal-regulation-harmonised-rules-fair-access-and-use-data.

aforementioned Data Act, on which we expand below. We start by noting that a generalized, mandatory approach to data sharing is far-reaching. It is a significant step beyond other data-sharing regimes, which sensibly focused on sectors where data – not software – is the main source of competitive advantage.

An often-lauded example is the EU's Open Banking framework. It is true that the EU's Payment Services Directive (PSD2) has largely delivered on its promise of innovation and competition[118]. Then again, the EU framework is not without its defects. First, the sharing obligations relate to granular, raw data associated with online payments, rather than encompassing all the financial information that banks possess. Second, third parties receiving data are required to obtain licences and undergo a thorough authorization process, although they should not face discrimination once they meet the requirements. Third, data sharing takes place through open APIs, but there is no standardized API for accessing the data. Fourth, the Open Banking revolution in the EU owes part of its success to the extensive digital reporting obligations imposed on financial institutions and intermediaries following the 2007 financial crisis, which is unique to this area.

A still sectoral but untested data sharing measure is provided by the DMA. It obliges gatekeeper search engines, in particular Google, to grant third parties "access on fair, reasonable and non-discriminatory terms to ranking, query, click and view data in relation to free and paid search generated by end users on its online search engines"[119]. The question is whether Google's competitive advantage stems from its large volume of queries, which it uses to optimize its search algorithm[120]. Another source of Google's competitive advantage is its web index, which is much larger than those of its competitors such as Microsoft's Bing[121]. This is so for

[118] PSD2 forces banks to share data with third parties after consent of the customer to whom the data belongs. See Directive (EU) 2015/2366 of the European Parliament and of the Council of 25 November 2015 on Payment Services in the Internal Market, Amending Directives 2002/65/EC, 2009/110/EC and 2013/36/EU and Regulation (EU) No 1093/2010, and Repealing Directive 2007/64/EC, OJ L337/35 § (2015).

[119] DMA, article 6(11).

[120] Kevin Coates, "Data: The uniqueness of the dataset and the slope of the value curve", *21st Century Competition*, 2020, https://www.twentyfirstcenturycompetition.com/2020/11/data-the-uniqueness-of-the-dataset-and-the-slope-of-the-value-curve/.

[121] Competition & Markets Authority, "Online platforms and digital advertising", *Market Study Final Report*, 2020, paragraphs 3.52-63, https://www.gov.uk/cma-cases/online-platforms-and-digital-advertising-market-study.

two reasons: first, more webmasters allow Google's crawler to index their pages, and second, crawling and indexing present a significant cost.

While the questions of competitive advantage have not been fully answered in relation to search engines, they already demand attention in the context of generative AI. There is agreement, at least, that the two most important inputs to build an LLM are computational power and training data[122]. Both are essential to train generative AI systems and thus develop increasingly accurate and effective models[123]. However, mandating access to computational power and training data diverges significantly from the obligations which currently exist in Open Banking, and needs to be balanced against potential dangers such as privacy concerns, security risks, possible bias, and lack of fairness[124].

One concern in generative AI is that incumbents lock up data that is now openly available. In the U.S. *Google* trial, for example, Microsoft CEO Satya Nadella testified: "What is publicly available today, will it be publicly available tomorrow? That's the issue"[125]. He was especially concerned that Google would conclude agreements with publishers to exclusively use their content for model training. Important repositories are already becoming more protective of their data. Reddit, the second-largest training resource of GPT-3, is limiting access to its APIs, effectively putting its data behind a paywall[126]. So long as this content is available to anyone willing to pay the price, that shift is competitively neutral. By contrast, if Google would conclude an exclusive agreement with Reddit to use its data to train its LLM, there might be an issue. This is especially so given that Google already benefits from having the largest web index, which is a valuable resource

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[122] Competition & Markets Authority, "AI foundation models", section 3.

[123] Xu Han et al., "Pre-trained models: Past, present and future", *AI Open* 2 (2021): 225-250.

[124] Abdulaziz Aldoseri, Khalifa N. Al-Khalifa and Abdel Magid Hamouda, "Re-thinking data strategy and integration for Artificial Intelligence: Concepts, opportunities, and challenges", *Applied Sciences* 13, no. 12 (2023): 7082.

[125] David Pierce, "Satya Nadella tells a court that Bing is worse than Google – and Apple could fix it", *The Verge*, 2023, https://www.theverge.com/2023/10/2/23900233/microsoft-ceo-satya-nadella-us-google-antitrust-trial-testimony. More generally, see James Somers, "How will A.I. learn next?", *The New Yorker*, 2023, https://www.newyorker.com/science/annals-of-artificial-intelligence/how-will-ai-learn-next.

[126] As long as API access is not granted exclusively, however, there is no comparative advantage for any one firm. See Umar Shakir, "Reddit's upcoming API changes will make AI companies pony up", *The Verge*, 2023, https://www.theverge.com/2023/4/18/23688463/reddit-developer-api-terms-change-monetization-ai.

for AI training[127]. It carried over this advantage from web search to model training: while only 6% of websites block Google AI's crawlers, almost 50% block those of OpenAI[128].

The way a model improves or learns is "by extracting generalizable patterns from their training dataset"[129]. Therefore, absent relevant data, there can be no pattern extraction or learning, and the model will not be fit-for-purpose. The importance of data access is perhaps even greater for domain-specific generative AI. For example, models used in health care need to have access to a sufficiently large, unbiased, complete, up-to-date high quality medical data. Non-specialized data, outside of the medical field, will not be useful, regardless of the amount of data. User customization is also important. LLMs needs to be able to interact with the user, which needs to share detailed data for the experience to improve. ChatGPT's limited but effective interoperability is one of the key traits of its success. Users can connect ChatGPT with other services and feed ChatGPT additional data from their desired sources, which customizes the output generated by the model[130].

As with search engines, the returns to more data are not yet fully clear. Nevertheless, sharing obligations may at some point prove justified. The Data Act takes steps to institute obligations on businesses that deliver data processing services. Data processing services are defined as "enabling ubiquitous, and on-demand network access to a shared pool of configurable, scalable and elastic computing resources (…) that can be rapidly provisioned and released with minimal management effort or service provider interaction"[131]. Generative AI development might be affected insofar as this provision applies to computing capabilities, including the manipulation, structuring, organising, and analysing of large amounts of data[132]. Providers of data processing services must facilitate the switching to or

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[127] Competition & Markets Authority, "AI foundation models", paragraph 3.9(a).

[128] "Who blocks OpenAI, Google AI and Common Crawl?", *Palewire*, 2023, https://palewi.re/docs/news-homepages/openai-gptbot-robotstxt.html.

[129] Hannah Brown et al., "What does it mean for a language model to preserve privacy?", *FAccT '22: 2022 ACM Conference on Fairness, Accountability, and Transparency* (2022): 2280-2292.

[130] Marcin Frąckiewicz, "The role of interoperability in the ChatGPT ecosystem", *TS2 SPACE*, 2023, https://ts2.space/en/the-role-of-interoperability-in-the-chatgpt-ecosystem/.

[131] Data Act, article 2.8.

[132] Statements on the Data Act are still speculative to some degree, as the Act is yet to start applying (it will do so from September 2025) and the specific requirements to characterise a data processing service *provider* (DPSP) are to be further specified.

simultaneous use of other providers of "the same service type"[133]. They must also become interoperable with other providers. Both switching and simultaneous use require the transfer of customer data to the alternative or additional provider. Many questions remain. For example, will the customer have the right to port only the input data provided to a generative AI model, or will the transport right also cover the specific output data generated[134]?

Overall, data sharing mandates can spur innovation but, to be effective, need to account for the specificities of the sector, including the relative importance of data versus other capabilities. Moreover, standardization is an essential prerequisite for data sharing, and policymakers at times underestimate the practical difficulty making the databases and datasets of different entities interoperable.

5. Conclusion

Modern debates on competition cannot escape the specter of concentration, and the view that "big is bad" is again gaining support. With *The New Goliaths*, Bessen offers a fresh take on those debates, for which he brings evidence (e.g., on disruption rates) and an underlying thesis (complexity competition). In debates on the nature of competition, however, the role of dynamism remains underappreciated. Though scholars have been building a dynamic competition paradigm for decades, its main tenets have not yet pierced the mainstream. We went over those tenets (including the sources of dynamism and the role of capabilities) to show specifically where dynamic competition theory deviates from other contemporary analyses. To bridge the gap between theory and practice, we relied on a case study of generative AI, the latest frontier of dynamic competition.

We then turned from theory to policy. Unbundling measures, which open up closed systems, are increasingly popular. The underlying idea is not that "big is bad" but rather that "closed is bad". We zoomed in on three unbundling measures that are being implemented in the EU: breaking ties, mandating interoperability, and imposing data sharing. Each measure can make sense in the right circumstances, as shown by our case study

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[133] Data Act, article 23.

[134] A related question is whether output data is covered by intellectual property rights. While the generative AI models and AI architecture are protected by such rights, the generated responses are often not original creative works or inventions. Therefore, they may not meet the conditions for such protection.

of generative AI, but there are challenges both conceptual (e.g., related to the ideal *degree* of openness) and practical (e.g., related to the standards required to effectively implement openness). A dynamic competition policy can help guide policymakers in tackling these challenges.

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