

ARTICLE

Can Telecommunications Regulation Inform Emerging Regulatory Approaches To Generative AI?: An Initial Inquiry

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1. Introduction

Generative artificial intelligence (“AI”) has captured the public’s imagination, sparking both excitement and concern about the future of this novel technology. AI “holds extraordinary potential for both promise and peril,” and “[h]arnessing AI for good and realizing its myriad benefits requires mitigating its substantial risks.”¹ This effort will require a range of policy tools, and competition law will play a key role among them.²

Governments, scholars, and commentators are beginning to confront the range of regulatory questions, including competition issues, that AI presents.³ As they do so, they can and should draw on regulatory history in industries with analogous features. Even imperfect analogies can provide valuable comparisons that draw on

¹ Exec. Order No. 14,110, *Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence* § 1(a) (Oct. 30, 2023) [hereinafter AI Executive Order]. The views expressed herein are in my personal capacity and do not necessarily reflect those of the United States Department of Justice, Antitrust Division. I appreciate research support from John Sullivan and insightful conversations with Susan Athey, and Jennifer Dixon.

² See *id.* §§ 1, 5.3.

³ See Tejas N. Narechania & Ganesh Sitaraman, *An Antimonopoly Approach to Governing Artificial Intelligence* (Vand. Pol’y Accelerator Working Paper, 2023), <https://ssrn.com/abstract=4597080>; Thibault Schrepel & Alex Pentland, *Competition Between AI Foundation Models* (MIT Connection Sci. Working Paper, Paper No. 1-2023), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4493900; Jai Vipra & Anton Korinek, *Brookings Inst., Market Concentration Implications of Foundation Models* (2023), <https://www.brookings.edu/wp-content/uploads/2023/09/Market-concentration-implications-of-foundation-models-FINAL-1.pdf>; Barry Lynn, Max von Thun, & Karina Montoya, *Open Mkts. Inst., AI in the Public Interest: Confronting the Monopoly Threat* (2023), <https://www.openmarketsinstitute.org/publications/report-ai-in-the-public-interest-confronting-the-monopoly-threat>.

decades of scholarship, trial and error, and real-world experience. Fields ranging from cybersecurity to nuclear power could offer lessons in the pros and cons of diverse regulatory approaches to specific issues presented by AI. Telecommunications, the focus of this essay, could be an important example—a highly imperfect analogy that still yields useful insights because of decades of research and regulatory experience.

This essay begins to explore the analogy between telecommunications and generative AI—specifically large language models—and suggests areas for further inquiry. In particular, the essay focuses on the history of telephony in the United States as a comparison point for generative AI. Part II discusses several notable similarities and differences between the two to lay a foundation for the discussion. Part III then discusses three specific features of telecommunications regulation that may offer insights for generative AI: *First*, high fixed costs alone do not prevent the development of robust competitive ecosystems with many competitors. *Second*, competitive markets with many access points can nonetheless support a robust security apparatus—with sufficient investment by both governments and market participants. And *third*, innovation thrives on competition at each layer of a technological ecosystem but can be curtailed by bottlenecks at any level. Part IV concludes by discussing avenues for further research raised by the comparison between telecommunications and generative AI.

2. Similarities and Differences Between the Telecommunications and Generative AI Value Chain

To understand how experiences from telecommunications regulation may carry lessons for the market for generative AI, we must first look at the similarities and differences between the two industries. Some initial thoughts: at a high level, both rely on (1) a high-fixed cost facilities layer; that (2) processes data and content; and (3) provides relatively low-cost access to consumers via an equipment or application layer. In generative AI, this means a foundation model that is trained on a corpus of text and other data generated primarily by humans.⁴ Once the model is trained, users can access it via an application layer for various functions. The wireline and mobile telephony systems, meanwhile, consist of wired or wireless networks that transmit user calls and messages to user devices for consumption.

Among the most prominent similarities between the two technologies are the substantial fixed costs of both time and money required to create either the AI model

⁴ See Working Grp. on Generative & NextGen AI: Safety & Assurance, Nat’l AI Advisory Comm., FAQs on Foundation Models and Generative AI 2-3 (2023), <https://ai.gov/wp-content/uploads/2023/09/FAQs-on-Foundation-Models-and-Generative-AI.pdf> [hereinafter NAIAC Report].

or the telecommunications network. The graphics processing unit (GPU) chips, data inputs, and months of computing power required to train an AI foundation model cost hundreds of millions, if not billions, of dollars.⁵ Building a wireless or wireline telecommunications network may involve antennas instead of chips or stringing wires instead of training time, but it similarly requires a multi-billion-dollar initial investment. Once these initial investments are completed, however, the marginal cost of providing access to the telecommunications network or the AI model could be relatively low.⁶

Both markets are also driven by innovation at each level. In AI, this includes the long-term iteration of foundation models and the development of applications that connect these models to users.⁷ In telecommunications, innovation is similarly driven by both periodic stepwise upgrades at the facilities layer (*e.g.*, the ongoing deployment of 5G infrastructure in the wireless sphere) and improvements in the equipment and applications that enable consumers to access and make use of the network.

Generative AI and telecommunications likewise raise related concerns about law enforcement coordination and access to user information. In the telecommunications sphere, Congress has established a regime that requires telecommunications providers to comply with lawful requests for wire taps, phone logs, cell site location data, and other forms of information.⁸ For AI, a prominent security concern is misuse of the model itself to provide users with instructions to make weapons or to engage in other harmful conduct.⁹ Thus, law enforcement coordination in the AI sphere may focus more on detecting malicious actors and blocking or monitoring their use of the system.

⁵ See *id.* at 6.

⁶ See Jonathan E. Nuechterlein & Philip J. Weiser, *Digital Crossroads: Telecommunications Law and Policy in the Internet Age* 142 (2d ed. 2013) (discussing telecommunications economics). In AI, marginal costs include both fine-tuning the model for particular purposes and the computational power required to process user queries. See Vipra & Korinek, *supra* note 3, at 9–10, 21; Tejas N. Narechania, *Machine Learning as Natural Monopoly*, 107 Iowa L. Rev. 1543, 1582 (2022) (noting that “the computational costs of responding to . . . individual queries are, as measured against the computational training costs, relatively small”). Although the per-query marginal cost of an AI-supported chatbot may be only several cents, the aggregate cost of operating such a chatbot could be hundreds of thousands of dollars a day. See *id.* at 21; Aaron Mok, *ChatGPT Could Cost Over \$700,000 Per Day to Operate. Microsoft Is Reportedly Trying to Make it Cheaper*, Bus. Insider (Apr. 20, 2023), <https://www.businessinsider.com/how-much-chatgpt-costs-openai-to-run-estimate-report-2023-4>.

⁷ See Narechania & Sitaraman, *supra* note 3 at 15–20 (discussing the model layer and the application layer of generative AI technology); Schrepel & Pentland, *supra* note 3 at 10 (analyzing the role of innovation in the model layer); Vipra & Korinek, *supra* note 3, at 3 (noting the importance of competition in the downstream application layer).

⁸ See *infra* Part III.B.

⁹ See AI Executive Order § 2(a)

Notwithstanding these similarities, there are key differences between telecommunications and generative AI. In AI, content is ingested and generated via the facilities layer; the model itself produces content in response to user queries. Telecommunications networks, meanwhile, are merely passive pipes that transmit content to user devices. The innovation cycle in AI also appears poised to occur at a much faster rate, at least in the coming years. OpenAI, for example, progressed from GPT-1 to GPT-4 in five years, while upgrades to telecommunications network technology occur closer to once or twice a decade.¹⁰ The types of network effects produced by these two technologies may also be different. In the early days of telecommunications, before the U.S. government imposed stricter interconnectivity regulations, network effects helped the Bell System obtain its nationwide monopoly position.¹¹ Generative AI models rely on a distinct but related self-reinforcing data network effect: the more a model is used, the more it can learn from these interactions.¹² Thus, popular models may improve more quickly, thereby attracting more users and creating a positive feedback loop.

The comparison to telecommunications also reveals another key avenue for further research. In telephony, the content that a user consumes, such as calls and text messages, come from another end user. They both benefit from the exchange and therefore continue making calls. Even if a mobile phone user accesses a social media application or a website, the content they receive on their phone has been created specifically for their and others' consumption. The social media site benefits from the extension of its audience to mobile phone users, and it can generate value from this audience. With AI foundation models, the value proposition may be different. The upstream content inputs, which enable the model to generate responses to user queries, have been created by humankind over generations for its own reasons. The people who created the corpus of texts and other data that an AI foundation model uses as inputs do not necessarily obtain any value from the flow of their content through the generative AI ecosystem. Thus, if AI models are able to extract value from content without providing any reciprocal benefit to those who created the content, we could find ourselves in a world without meaningful investment or

¹⁰ See Bernard Marr, *A Short History Of ChatGPT*, Forbes (May 19, 2023), <https://www.forbes.com/sites/bernardmarr/2023/05/19/a-short-history-of-chatgpt-how-we-got-to-where-we-are-today/>; Larry Downes, *What Is 5G and Why Should Lawmakers Care?*, Wash. Post (Oct. 26, 2017), <https://www.washingtonpost.com/news/innovations/wp/2015/10/26/what-is-5g-and-why-should-lawmakers-care/>.

¹¹ See Nuechterlein & Weiser, *supra* note 6, at 3–5.

¹² See Narechania & Sitaraman, *supra* note 3, at 26–27. In a 2021 paper, Professors Hagiu and Wright presented a conceptual framework for this type of “data-enabled learning” and showed how firms that can acquire more data about their products from customers and process this data more efficiently can gain a competitive advantage. See Andrei Hagiu & Julian Wright, *Data-Enabled Learning, Network Effects and Competitive Advantage* (Working Paper, 2021), <https://andreihagiu.com/wp-content/uploads/2021/06/Data-enabled-learning-May-2021.pdf>.

competition in content creation itself. If all human-generated content is ingested by generative AI models and then synthesized to create other content without meaningful compensation for the human creator, the supply of that human-generated content will diminish. This risk is exacerbated by the relatively low marginal cost of generating AI content, such as visual art or prose, when compared to the labor cost of human-generated content. Social media sites and search engines are currently having a similar effect on news media by extracting content from news sites while capturing advertising revenues for themselves.¹³ If AI systems monetize broader types of content in a way that does not adequately compensate creators, they risk hollowing out the content creation ecosystem in the long term.

With these comparisons in mind, we can turn to specific experiences from telecommunications regulation that may shed light on the market for generative AI.

3. Lessons from the History of Telecommunications Regulation

3.1. Markets with High Fixed Costs Can Still Support Many Competitors

As noted above, the development of both AI foundation models and telephony networks requires massive initial investments of money and time. These fixed costs pose a significant barrier to potential new entrants. Nonetheless, the telecommunications industry shows that markets with this structure can still support some degree of competition.¹⁴ Currently, AT&T, Verizon, and T-Mobile hold significant market shares in the wireless market, with DISH offering a fourth network in many locations. Moreover, other mobile network operators like U.S. Cellular continue to operate in the market despite their much smaller scale. Even in the wireline market, where regulatory hurdles and density permit, there are often two or more fixed network providers.¹⁵ Overall, these competitive ecosystems represent a substantial increase in competition from the control that the Bell System exercised over telephony before its breakup in 1982.

The telephony example suggests that the market for generative AI can sustain multiple competitors despite the investments required to develop foundation models. As in the telecommunications industry, these massive fixed cost expenses by different firms may be somewhat duplicative: telephonic networks rely on their own separate infrastructure to cover overlapping areas, while foundation model developers rely on similar datasets and similar transformer-based neural network architectures.¹⁶ Generative AI also parallels telephony in its high fixed costs and

¹³ See Lynn, von Thun, & Montoya, *supra* note 3, at 25.

¹⁴ See Nuechterlein & Weiser, *supra* note 6, chs. 2.IV, 4.III.

¹⁵ See *id.* at 54–56. Some of this competition is driven by the historical development in the United States of separate telephone and cable television networks, which have converged and now both support competing broadband services. See *id.* at 18.

¹⁶ See NAIAC Report at 4–5.

supply-side economies of scale. The hundred-million-dollar investments in processing chips and computing resources to develop successive iterations of foundation models are sunk costs that give incumbents an advantage over new entrants seeking to build a latest-generation model from scratch.¹⁷ The magnitude of these fixed costs, compared to the relatively low cost of model queries, creates significant economies of scale for the large foundation model developers.¹⁸ But despite characteristics like these, the telephony market has been able to fund multiple major competitors rather than a single monopolist. They have benefitted from a shared ecosystem, enabled in part by open and transparent standards processes that, when appropriately implemented, can support competition. Moreover, it has been competition among network operators—rather than a regulatory regime that required shared network facilities in order to reduce duplication—that has encouraged routine innovative network upgrades.¹⁹ Competition among AI foundation models may similarly foster innovation as firms continue to train new versions of their models.²⁰

3.2. Competitive Markets are Consistent with a Robust Security Apparatus if Firms and Governments Invest

Open-source development has led to more competitive markets in other digital technologies and may bring the same benefits to generative AI. Some commentators, however, have raised concerns that open-source foundation models could pose security risks. An AI chatbot could, for example, be prompted to provide instructions for creating a biological weapon, explosive, or other dangerous device.²¹ Although closed-source models can limit this type of usage, models with published and editable model weights could be modified to permit this behavior.²²

Although telecommunications technology does not present precisely the same risks, our experience in that sector shows that effective law enforcement coordination is possible even in a market with several large independent competitors and many access points. Telecommunications have been exploited by criminals to facilitate lawbreaking for a century, as highlighted by the prohibition-era bootlegging operation and the subsequent wiretap case that led to Justice Brandeis’

¹⁷ See Vipra & Korinek, *supra* note 3, at 12.

¹⁸ See *id.* at 9–10.

¹⁹ See Michal Grajek & Lars-Hendrik Röller, *Regulation and Investment in Network Industries: Evidence from European Telecoms*, 55 J.L. & Econ. 189, 194 (2012) (noting that requiring firms in network industries to share facilities can increase efficiency by reducing duplication but may diminish investment incentives in the long run).

²⁰ See Vipra & Korinek, *supra* note 3, at 9; Narechania, *supra* note 6, at 1574.

²¹ See AI Executive Order § 2(a) (noting that making AI safe and secure “requires addressing AI systems’ most pressing security risks — including with respect to biotechnology, cybersecurity, critical infrastructure, and other national security dangers”).

²² See Vipra & Korinek, *supra* note 3, at 28.

famous *Olmstead* dissent.²³ Today, after decades of legislative, judicial, and regulatory evolution, the three major mobile network operators in the United States together receive thousands of requests per day from law enforcement agencies.²⁴ Smaller competitors such as U.S. Cellular are also subject to these requests. These providers have developed robust response processes, including service centers specifically dedicated to law enforcement and standardized data reporting systems.²⁵ Agencies, meanwhile, have developed their own procedures to manage the different technologies that providers use and the different types of data they are able to provide.²⁶ And in the internet communications sphere, some providers voluntarily screen messages for child pornography and report them to the National Center for Missing and Exploited Children.²⁷ In both industry and government, investments have been made in developing necessary technologies and hiring sufficient staff to manage the massive day-to-day operations these law enforcement priorities require.

The telecommunications and law enforcement ecosystem has also been supported by legislative action. Congress has enacted detailed legislation to ensure that law enforcement has access to telecommunications information while providing legal safeguards. These statutes, including the Communications Assistance for Law Enforcement Act, the Stored Communications Act, the pen register and trap and trace statutes, and the Foreign Intelligence Surveillance Act, set forth the types of information that may be requested, the procedures and legal burdens for each, and the circumstances in which judicial review is required.²⁸ The wide range of circumstances covered by these statutes reflects Congress's careful attention to changes in communications technology and the needs of law enforcement.

The specifics of the telecommunications regime will not map directly onto generative AI and the unique threats that it poses. For example, the intra-national scope of most telecommunications companies makes coordination with national law

²³ See generally *Olmstead v. United States*, 277 U.S. 438 (1928).

²⁴ See Verizon, U.S. Transparency Report 2023 (1st Half) 2 (2023), <https://www.verizon.com/about/sites/default/files/US-Transparency-Report-1H-2023.pdf>; AT&T, August 2023 Transparency Report 3 (2023), <https://about.att.com/content/dam/csr/2023/Transparency2023/2023-Aug-Transparency-Report.pdf>; T-Mobile, Transparency Report for 2022 5 (2022), https://www.t-mobile.com/news/_admin/uploads/2023/07/2022-Transparency-Report.pdf.

²⁵ See Cellular Analysis Survey Team, Fed. Bureau of Investigation, Cellular Analysis & Geo-Location Field Resource Guide 79–84, 89–95, 106–112, 123–128 (2019) [hereinafter CAST Field Resource Guide].

²⁶ See *id.* at 73–76.

²⁷ See *United States v. Wilson*, 13 F.4th 961, 964–65 (9th Cir. 2021) (describing Google's process for identifying and reporting apparent child pornography).

²⁸ See generally Gina Stevens & Charles Doyle, Cong. Rsch. Serv., 98-326, Privacy: An Overview of Federal Statutes Governing Wiretapping and Electronic Eavesdropping (2012).

enforcement agencies simpler than it would be with global AI firms. Nonetheless, the examples highlighted above indicate that multinational internet companies can effectively coordinate with national enforcers. The risk posed by the misuse of AI may also spur law enforcement coordination at an international level. Furthermore, the effective combination of Congressional action and law enforcement-provider cooperation that is evident in this telephony regime in the United States suggests that an equivalent system could be developed for AI. Notably, the telecommunications experience suggests that having multiple private competitors and many individual access points is not a barrier to success in developing a security apparatus,²⁹ but that it does require engagement and investment at many levels of law enforcement ranging from local police departments to Congressional action.

3.3. Competition in Every Part of the Ecosystem Is Critical to Innovation

The history of the telecommunications industry also shows that competition in each part of an innovation ecosystem is critical to dynamic competition across that ecosystem. Before its breakup in 1984, the Bell System’s holding company, AT&T, controlled more than 85% of local telephone services, 85% of long-distance services (through its AT&T Long Lines subsidiary), and 82% of the market for telephone equipment (through its Western Electric subsidiary).³⁰ Bell used its control over local telephone services, in which there were greater barriers to effective competition, to exclude others from the potentially competitive markets for telecommunications equipment and the provision of long-distance services.³¹

Even after a 1956 consent decree required Bell Laboratories—the Bell System’s research center—to license all of its patents on a royalty-free basis, Bell’s dominant, vertically integrated position continued to stifle outside innovation in the telecommunications industry.³² In the equipment sector, Bell maintained control through a rule preventing consumers from attaching other companies’ equipment to Bell telephone lines.³³ Despite these exclusionary monopolistic practices many

²⁹ See CAST Field Resource Guide at 135–39 (describing processes for requesting and interpreting data from U.S. Cellular).

³⁰ See Martin Watzinger & Monika Schnitzer, *The Breakup of the Bell System and its Impact on US Innovation* 1 (Ctr. For Econ. Pol’y Rsch., Discussion Paper No. 17635, 2022).

³¹ See *id.* at 4. Although Bell’s control over local markets was justified as a natural monopoly, more recent research has called even this premise into question. See Wu, *supra* note 19, at 422; Gerald R. Faulhaber, *Bottlenecks and Bandwagons: Access Policy in the New Telecommunications*, in *Handbook of Telecommunications Economics* 488 (Vogelsang and Cave eds., 2004).

³² See Martin Watzinger et al., *How Antitrust Enforcement Can Spur Innovation: Bell Labs and the 1956 Consent Decree*, 12 Am. Econ. J.: Econ. Pol’y 328, 330 (2020) (showing that compulsory licensing of Bell’s patents, 57% of which had main applications in industries outside of telecommunications, led to increased innovation in those other industries but not in telecommunications itself).

³³ See Tim Wu, *Wireless Carterfone*, 1 Int’l J. Comm’n 389, 395 (2007). The 1934 Telecommunications Act permitted AT&T to file with the FCC “classifications, practices, and regulations” affecting its phone service. See *id.* (quoting 47 U.S.C. § 203(a)).

feared that interfering with the vertically integrated monopoly that funded Bell Laboratories would do more harm than good.³⁴ Bell Laboratories had produced important technological innovations, producing multiple Nobel Prizes and Turing Awards.³⁵ In the 1970s, Bell accounted for between 0.5% and 1% of all U.S. patents filed by U.S. inventors each year.³⁶ Thus, breaking up the vertically integrated monopoly that funded and directed Bell Laboratories could have interfered with technological innovation even as it opened up the market to contributions from other firms.

Empirical research, however, shows that breaking Bell's hold on the equipment layer of the telecommunications market spurred investment and innovation, notwithstanding Bell Laboratories' record of innovation. First, courts and the FCC began to erode Bell's restrictions on attaching equipment to its telephone networks, most prominently in the F.C.C.'s 1968 *Carterfone* decision.³⁷ This shift in regulatory policy eventually led to a standardized network interface (*i.e.*, the RJ-11 U.S. phone jack) that enabled equipment competitors to innovate on top of the infrastructure provided by Bell's telephone network.³⁸ These changes brought new choices to consumers in the market for telephone equipment, with the number of firms in the industry nearly doubling in the five years between 1967 and 1972.³⁹ Perhaps more importantly, they led to entirely new inventions like the fax machine, the answering machine, and the computer modem.⁴⁰

The breakup of the Bell System in 1982 further opened the equipment market and the broader telecommunications market to innovation. Through a consent decree, AT&T agreed to divest control of its local telephone providers, which were broken up into regional operating companies.⁴¹ Through this divestiture AT&T was able to retain control over Western Electric and AT&T Long Lines. These companies, however, could no longer rely on their near-exclusive access to the Bell local

³⁴ See Watzinger & Schnitzer, *supra* note 30, at 5.

³⁵ See Iulia Georgescu, *Bringing Back the Golden Days of Bell Labs*, 4 Nat. Rev. Phys. 76, 76 (2022).

³⁶ See Watzinger & Schnitzer, *supra* note 30, at 5.

³⁷ See *In re Use of the Carterfone Device in Message Toll Tel. Serv.*, 13 F.C.C.2d 420, 424 (1968); see also *Hush-A-Phone Corp. v. FCC*, 238 F.2d 266, 269 (D.C. Cir. 1956) (earlier decision allowing attachment of non-AT&T equipment that did not affect the phone or the network).

³⁸ See Wu, *supra* note 33, at 397.

³⁹ See Steven G. Olley & Ariel Pakes, *The Dynamics of Productivity in the Telecommunications Equipment Industry*, 64 Econometrica 1263, 1268 (1996).

⁴⁰ See Everett M. Ehrlich et al., *The Impact of Regulation on Innovation and Choice in Wireless Communications*, 9 Rev. Network Econ. art. 2, 25 (2010); see also Wu, *supra* note 33, at 397 ("The 1968 *Carterfone* right to attach devices to home networks is perhaps the fundamental consumer right in telecom, and . . . [it] has had enormous consequences not only in telecommunications policy, but for the economic prosperity of the United States."); Mark A. Lemley & Lawrence Lessig, *The End of End-to-End: Preserving the Architecture of the Internet in the Broadband Era*, 48 UCLA L. Rev. 925, 936 (2001) ("Without [the *Carterfone*] changes brought about by the government, the Internet as we know it would not have been possible.").

⁴¹ *United States v. Am. Tel. & Tel. Co.*, 552 F. Supp. 131, 160 (D.D.C. 1982).

networks.⁴² In 1982, the local Bell operating companies purchased 92% of their telecommunications equipment from Western Electric.⁴³ Only four years later, that number had fallen to 58%. The breakup of Bell’s vertical monopoly and the separation of the local Bell operators into multiple potential customers spurred competition in the equipment and long-distance markets even though AT&T retained control of its subsidiaries in these sectors. An analysis of the number and types of patents filed in the years before and after the breakup similarly shows that both the rate and diversity of innovation in the telecommunications industry increased after the Bell breakup.⁴⁴ Moreover, the number of high-quality patents produced by Bell Laboratories itself was not diminished by the breakup.⁴⁵

In the generative AI ecosystem, the massive computing costs required to develop foundation models suggests that this stage of the market may be concentrated, even in a long-run competitive environment. But the barriers to entry at the user application stage are much lower, just as they were in the telephone equipment market.⁴⁶ Even though competition should have been easier at the telephone equipment layer, Bell was able to use its vertical control over the industry to block consumers’ access to new, innovative equipment. This history suggests that the large foundation model developers could suppress competition and stifle important technological innovations by exerting vertical control over user application development.⁴⁷ Rather than AT&T’s no-attachment rule, these firms may be able to control the user application market through app stores and restrictive licenses that developers must accept in exchange for access to the foundation model.⁴⁸ Regulators therefore must apply careful scrutiny to such strategies. *Carterfone* and its progeny also suggest that regulations requiring standardized interfaces might promote competition in the downstream user application market even if the upstream foundation model market remained concentrated.

The telecommunications experience also suggests that promoting competition in the quality of foundation models may be important to spur innovation at the application layer. If, for example, only a few models are usable for a particular

⁴² See Watzinger & Schnitzer, *supra* note 30, at 9.

⁴³ See Olley & Pakes, *supra* note 39, at 1269.

⁴⁴ See Watzinger & Schnitzer, *supra* note 30, at 16–17, 31–32. The authors measured the diversity of innovation by analyzing the number of patents filed in different granular technology classifications areas as defined by the U.S. Patent and Trademark Office. See *id.* at 29–30.

⁴⁵ See *id.* at 21.

⁴⁶ See Narechania & Sitaraman, *supra* note 3, at 20.

⁴⁷ Some commentators have already called attention to the control that large tech companies are able to exert over the direction of AI research. See Lynn, von Thun, & Montoya, *supra* note 3, at 20, 25.

⁴⁸ While the foundation model firms likely will not enjoy the monopolistic control that Bell Systems did at the local telephone services level, the fact that these firms “are able to control entry into vertical markets suggests that they wield market power.” See Wu, *supra* note 33, at 394.

application type and each of those models is flawed, innovation in this application area will suffer.⁴⁹ Thus, even if there are only a handful of firms with the resources to develop foundation models, promoting quality competition among these firms may be important because model quality interacts with application quality and may improve competition at that downstream layer. Similar considerations could apply to other potential chokepoints, including the chips used to process data or proprietary data itself, all of which may benefit from open or interoperable approaches similar to aspects of the telecommunications ecosystem. Interoperability requirements at the cloud computing layer, for example, could help to prevent dominant players in that industry from exerting undue control over generative AI development.⁵⁰ Interoperability between foundation models could similarly benefit application developers, facilitating innovation in the same way that *Carterfone* did for wireline telecommunications.⁵¹

4. Conclusion

This essay suggests that, as the public considers the interaction between government and groundbreaking AI technology, policymakers should consider the lessons of history. Conditions such as high fixed costs, security concerns, and the potential for vertical integration have long been features of the telecommunications industry, just as they are now in the generative AI sector. These comparisons between telecommunications and generative AI present avenues for additional research into the most effective ways to foster competition and innovation in the market for generative AI. Further inquiry into the telecommunications example presented here and other potential analogs may prove useful as we continue to monitor the developing market for generative AI systems. Similar examination into the lessons to be gleaned from other policy areas would be a fertile ground for interdisciplinary study.

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⁴⁹ See Narechania & Sitaraman, *supra* note 3, at 27.

⁵⁰ See Lynn, von Thun, & Montoya, *supra* note 3, at 43.

⁵¹ See Vipra & Korinek, *supra* note 3, at 36.