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Open Access, Interoperability, and DTCC's Unexpected Path to Monopoly

ABSTRACT. For markets characterized by significant economies of scale, scholars and policy-makers often advance open-access and interoperability requirements as superior to both regulated monopoly and the breakup of dominant firms. In theory, by compelling firms to coordinate in the development of common infrastructure, these requirements can replicate the advantages of scale without leaving markets vulnerable to monopoly power. Examples of successful coordination include the provision of electricity, intermodal transportation, and credit-card networks.

This Article offers a qualification to this received wisdom. By tracing the Depository Trust and Clearing Corporation's path to monopoly in the U.S. securities clearing and depository markets, it demonstrates that open-access and interoperability requirements can serve as instruments by which dominant firms obtain and entrench their monopoly power. Specifically, by imposing high fixed costs to connect to common infrastructure, allowing dominant firms to dictate the direction and pace of innovation and investment, and reducing the scope for product differentiation, these requirements can prevent smaller firms from competing with their larger rivals. In these ways, open access and interoperability can exacerbate the very problems they were designed to address.

Our analysis helps to explain why important components of our financial infrastructure have become too big to fail. It also helps explain why, despite their highly concentrated structure, U.S. securities clearing and depository markets still exhibit relatively high levels of innovation and investment. More broadly, our analysis offers a cautionary tale for policymakers seeking to employ open-access and interoperability requirements to curb growing market power in Big Tech, social media, finance, and elsewhere. Open access and interoperability are unlikely to constrain market power unless larger firms are unable to dictate decisions about innovation and investment, and unless the costs of building, maintaining, and connecting to common infrastructure are allocated in a way that does not discriminate against smaller firms. Where this is not possible, open access and interoperability are unlikely to forestall monopoly control, though they might still improve market efficiency by exposing incumbents to the threat of new entry.

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INTRODUCTION

Antitrust is enjoying something of a resurgence. A group of scholars known as the “New Brandeisians” have forcefully argued that antitrust—and antimonopoly more generally¹—offers not just economic benefits, but also political ones.² In addition to raising traditional concerns about economic efficiency, these scholars contend that large concentrations of economic power exacerbate income inequality, undermine the free expression of ideas, and threaten the democratic political process.³ Echoing this view, a 2020 report published as part of the House Judiciary Committee’s investigation of competition in digital markets concluded that the largest tech firms “wield their dominance in ways that erode entrepreneurship, degrade Americans’ privacy online, and undermine the vibrancy of the free and diverse press. The result is less innovation, fewer choices for consumers, and a weakened democracy.”⁴

But bigger sometimes really is better. When industries exhibit significant economies of scale, it is often more efficient for a small number of firms to supply the entire market.⁵ In fact, scholars and policymakers have argued over the past century that various industries are natural monopolies best served by a single firm.⁶ Today, these arguments are echoed by those who believe that the biggest

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1. The term “antimonopoly” is broader than “antitrust” and refers to a menu of policy interventions that would check concentrations of economic power. See Lina Khan, *The New Brandeis Movement: America’s Antimonopoly Debate*, 9 J. EUR. COMPETITION L. & PRAC. 131, 131 (2018).
 2. See, e.g., TIM WU, *THE CURSE OF BIGNESS: ANTITRUST IN THE NEW GILDED AGE* 23 (2018); Lina M. Khan, *The End of Antitrust History Revisited*, 133 HARV. L. REV. 1655, 1658, 1681 (2020) (reviewing WU, *supra*).
 3. See, e.g., Lina Khan & Sandeep Vaheesan, *Market Power and Inequality: The Antitrust Counterrevolution and Its Discontents*, 11 HARV. L. & POL’Y REV. 235, 235-36 (2017); Sanjukta Paul, *Antitrust as Allocator of Coordination Rights*, 67 UCLA L. REV. 378, 381-82 (2020). Concerns about the relationship between economic concentration and political power have a long tradition. For a historical account of concerns about foreign control over platforms, see Ganesh Sitaraman, *The Regulation of Foreign Platforms*, 74 STAN. L. REV. 1073, 1106-27 (2022).
 4. MAJORITY STAFF OF THE SUBCOMM. ON ANTITRUST, COM. & ADMIN. L. OF THE H. COMM. ON THE JUDICIARY, 116TH CONG., *INVESTIGATION OF COMPETITION IN DIGITAL MARKETS: MAJORITY STAFF REPORT AND RECOMMENDATIONS* 7 (2020).
 5. See *infra* Section I.B for a more detailed description of economies of scale, scope, and network effects, along with their relationship with (natural) monopolies.
 6. See, e.g., ALFRED E. KAHN, *THE ECONOMICS OF REGULATION: PRINCIPLES AND INSTITUTIONS* 11 (1988) (explaining that many regulated monopolies are “natural monopolies” whose “costs will be lower if they consist in a single supplier”); Morgan Ricks, *Money as Infrastructure*, 2018 COLUM. BUS. L. REV. 757, 768-69; Samuel Insull, *Standardization, Cost System of Rates, and Public Control* (June 7, 1898), in *CENTRAL-STATION ELECTRIC SERVICE: ITS COMMERCIAL DEVELOPMENT AND ECONOMIC SIGNIFICANCE AS SET FORTH IN THE PUBLIC ADDRESSES* (1897-

tech platforms and financial institutions have become “essential social, economic, and political infrastructure.”⁷ On this view, financial services and the digital marketplace are “the railroads, bridges, and telegraph lines of a century ago.”⁸

1914) OF SAMUEL INSULL 34, 34-47 (William Eugene Kelly ed., 1915) (arguing that electricity is a natural monopoly and should be rate regulated); Richard J. Pierce Jr., *The Evolution of Natural Gas Regulatory Policy*, 10 NAT. RES. & ENV'T 53, 53 (1995) (stating that, in the 1920s, “[i]t made sense to regulate interstate pipelines because interstate transportation of gas, like distribution of gas by local distribution companies (LDCs), was a natural monopoly function”); Herbert Hovenkamp, *Technology, Politics, and Regulated Monopoly: An American Historical Perspective*, 62 TEX. L. REV. 1263, 1268 (1984) (“The proliferation of such monopolies was justified at that time by the precapitalist economic view that in certain markets with high start-up costs no private entrepreneur would invest his money unless he was guaranteed freedom from competitive entry.”); Charles F. Adams Jr., *The Government and the Railroad Corporations*, 112 N. AM. REV. 31, 57 (1871) (“Railroad corporations are often spoken of as trustees for the public. . . . They receive from the community the monopoly of a proposed thoroughfare; the consideration they pay for this estate is the transportation over it, under certain conditions, of all persons and property that offer.”); Adam D. Thierer, *Unnatural Monopoly: Critical Moments in the Development of the Bell System Monopoly*, 14 CATO J. 267, 267 (1994) (“Most legislators, academics, and many others believe the telephone industry is a natural monopoly that was privately monopolized by the aggressive actions of the American Telegraph and Telephone Company (AT&T).”); David B. Spence, *Can Law Manage Competitive Energy Markets?*, 93 CORNELL L. REV. 765, 767-70 (2008) (providing a history of public control of energy markets); Bruce Wyman, *The Law of Public Callings as a Solution of the Trust Problem*, 17 HARV. L. REV. 156, 160-61 (1904) (arguing that the distinguishing feature of public utilities is that they are “virtual monopol[ies]”); Max Edelstein, *We Need to Regulate Big Data as a Public Utility*, COLUM. POL. REV. (July 3, 2022), <http://www.cpreview.org/blog/2022/7/we-need-to-regulate-big-data-as-a-public-utility> [<https://perma.cc/F3JR-QVKB>] (“It would be incredibly inefficient and expensive for multiple companies to set up water and power lines to every single house, instead of just having one. Because of the inherent advantages of being a sole provider of these services, these industries naturally monopolize.”); Joseph D. Kearney & Thomas W. Merrill, *The Great Transformation of Regulated Industries Law*, 98 COLUM. L. REV. 1323, 1325 (1998) (arguing that deregulation of a variety of public-utility industries retains many features of public-utility regulation). Justice Story offered an early version of the natural-monopoly argument when he suggested that bridges were natural monopolies in his dissenting opinion in *Charles River Bridge v. Warren Bridge*, 36 U.S. (11 Pet.) 420 (1837). Story claimed that failure to provide monopoly protection in high-investment industries would “arrest all public improvements.” *Id.* at 608 (Story, J., dissenting).

7. *Proposals to Strengthen the Antitrust Laws and Restore Competition Online: Hearing Before the Subcomm. on Antitrust, Com. & Admin. L. of the H. Comm. on the Judiciary*, 116th Cong. 96 (2020) (statement of K. Sabeel Rahman, President, Dēmos).
8. *Id.*; see also Ricks, *supra* note 6, at 757 (arguing that bank regulation should be “understood as a subfield of infrastructure regulation”).

These scale benefits pose unique regulatory challenges. As a preliminary matter, the drive to capitalize on the advantages of scale can lead firms to compete not just *in* the market but *for* the market.⁹ In the process, competing firms might make investments that turn out to be duplicative once a single firm secures monopoly control.¹⁰ After securing a monopoly, the winner may take advantage of its dominant market position by engaging in abusive pricing practices or other anticompetitive conduct.¹¹ Monopoly control can also discourage innovation, with monopolists making investments designed to entrench their dominant position, thereby deterring investments by new and potentially more innovative firms.¹² And, last but not least, depending on the nature of the products and services they supply, dominant firms might become systemically important, effectively forcing governments to bail them out during periods of financial distress. This is the so-called “too big to fail” problem that entered the public consciousness in the wake of the 2008 financial crisis.¹³

Proponents of more robust antitrust enforcement have long recognized the limits of traditional antitrust remedies in industries characterized by significant economies of scale. These remedies range from fines for abusive conduct, to rate regulation coupled with strict government oversight, to the breakup of dominant firms.¹⁴ Instead, scholars and policymakers have advocated for regulatory

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9. See Michael Kades & Fiona M. Scott Morton, *Interoperability as a Competition Remedy for Digital Networks* 1 (Feb. 2021) (unpublished manuscript), <https://ssrn.com/abstract=3808372> [<https://perma.cc/UR8G-RDYY>] (“[T]he competition that matters most is often for the market not within the market. Anticompetitive conduct is more likely to succeed. And the harm to consumers is greater because the market tends to be winner-take-all, or most . . .”).
 10. See *id.*; KAHN, *supra* note 6, at 123 (explaining that, in the context of telephone providers, multiple providers serving a single community could make it necessary for consumers to pay for “two instruments, two lines into his home, two bills”).
 11. See Kades & Scott Morton, *supra* note 9, at 1.
 12. See Michael Riordan, *No Monopoly on Innovation*, HARV. BUS. REV. (Dec. 2005), <https://hbr.org/2005/12/no-monopoly-on-innovation> [<https://perma.cc/3LZH-2PJP>] (“Many economists argue that monopolies stifle innovation. The lack of competition induces corporate somnolence, and new technologies are patented mainly to consolidate and protect a company’s dominant market position rather than to encourage the creation of revolutionary products and services.”).
 13. Ben S. Bernanke, *Ending “Too Big to Fail”: What’s the Right Approach?*, BROOKINGS INST. (May 13, 2016), <https://www.brookings.edu/blog/ben-bernanke/2016/05/13/ending-too-big-to-fail-whats-the-right-approach> [<https://perma.cc/2KHG-WR69>].
 14. See, e.g., Daniel Schwarcz, *Ending Public Utility Style Rate Regulation in Insurance*, 35 YALE J. ON REGUL. 941, 950–51 (2018) (describing rate regulation as an early tool of public-utility regulation); *Antitrust Division Policy Guide to Merger Remedies*, U.S. DEP’T OF JUST. 12–18 (2011), <https://www.justice.gov/atr/page/file/1098656/download> [<https://perma.cc/3TXV-Y8T8>] (describing conduct remedies); *Antitrust Division Policy Guide to Merger Remedies*, *supra*, at 35

strategies that compel market participants to *coordinate* development and maintenance of socially useful market infrastructure.¹⁵ These coordination mechanisms include *open-access* and *interoperability* requirements. Interoperability requirements compel firms to work together to develop products and services compatible with those offered by their competitors. Interconnection requirements, a species of interoperability requirements, compel firms to build, maintain, and connect to common infrastructure through which to provide their goods and services. Open-access requirements, meanwhile, ensure that firms that exercise control over this infrastructure make it available to new entrants on competitive terms.¹⁶

Together, open-access and interoperability requirements are designed to forestall monopoly control, thereby mitigating market-power abuses and ameliorating the too-big-to-fail problem.¹⁷ In theory, these requirements also allow

(explaining that fines are an appropriate remedy for noncompliance); Herbert Hovenkamp, *Antitrust and Platform Monopoly*, 130 YALE L.J. 1952, 2009-10 (2021) (describing the breakup of AT&T).

15. See, e.g., Kades & Scott Morton, *supra* note 9, at 2; Hovenkamp, *supra* note 14, at 1957 (arguing that “forced interoperability or pooling . . . can make markets more efficient by broadening the range of positive network effects . . . [and] enable greater competition without jeopardizing productivity and consumer value”); Douglas Lichtman & Randal C. Picker, *Entry Policy in Local Telecommunications: Iowa Utilities and Verizon*, 2002 SUP. CT. REV. 41, 42 (“Without mandatory sharing, a competitor can enter the market only if it can either cut a deal with an existing telephone company or build its own network from the ground up. With mandatory sharing, by contrast, a competitor has a third option: it can enter the market in stages, building part of its network itself but then leasing the rest at regulated rates from existing firms.”); Telecommunications Act of 1996, Pub. L. No. 104-104, §§ 251-252, 110 Stat. 56, 61-70 (codified as amended at 47 U.S.C. §§ 251-252) (requiring incumbent local telephone carriers to lease parts of their telephone networks to potential rivals); cf. Randal C. Picker, *Regulating Network Industries: A Look at Intel*, 23 HARV. J.L. & PUB. POL’Y 159, 159-60 (1999) (considering when central oversight improves efficiency in network industries).
16. See, e.g., National Securities Clearing Corp.: Proposed Rule Change, 42 Fed. Reg. 44052, 44053 (proposed Aug. 5, 1977) (noting that the Securities and Exchange Commission (SEC) ordered the National Securities Clearing Corporation (NSCC) to “offer to operate such interfaces under an agreement wherein the parties to the interfaces would not charge each other for interface movements or charge their participants, either an interface fee or any fee which would operate as an interface fee”). Nondiscrimination requirements, which force firms to offer homogenous prices and equal-quality service, are another common coordination requirement. See, e.g., Promoting Wholesale Competition Through Open Access Non-Discriminatory Transmission Services by Public Utilities, 61 Fed. Reg. 21540, 21541 (Apr. 24, 1996) (codified at 18 C.F.R. pts. 35, 385) (imposing coordination requirements on public utilities that operate electric-energy-transmission facilities).
17. See MAJORITY STAFF OF THE SUBCOMM. ON ANTITRUST, COM. & ADMIN. L. OF THE H. COMM. ON THE JUDICIARY, 116TH CONG., INVESTIGATION OF COMPETITION IN DIGITAL MARKETS: MAJORITY STAFF REPORT AND RECOMMENDATIONS 20 (2020) (proposing “[i]nteroperability and data portability . . . [that] requir[e] dominant platforms to make their services compatible with various networks and to make content and information easily portable between them”).

firms to capture the benefits of scale without granting a single firm monopoly control over an entire industry.¹⁸ For that reason, regulators have often used open access and interoperability to regulate so-called “public utilities”: firms that provide essential public infrastructure like roads, water, and electricity, and that often enjoy legal protection from competition.¹⁹

Recognizing these potential benefits,²⁰ the New Brandeisians have urged regulators to use open-access and interoperability requirements to force competing firms to coordinate in developing and maintaining common infrastructure.²¹ And regulators seem increasingly sympathetic to this approach. On October 20, 2020, the Department of Justice (DOJ) filed a complaint against Google alleging that the firm’s control of popular access points has undermined the emergence of the next generation of internet-search platforms.²² Less than two months later, the Federal Trade Commission (FTC) filed a complaint against Facebook alleging that the social network “enforced anticompetitive conditions on access to its valuable platform interconnections.”²³ Beyond Silicon Valley, as of 2021 no

18. See Kades & Scott Morton, *supra* note 9, at 2 (“[I]f a firm illegally protected its monopoly through serial acquisitions, network effects and susceptibility towards tipping made the serial acquisition strategy effective[.] Interoperability will make the serial acquisition strategy less effective, should it be tried again. New entry is more likely because the network effect would not be a barrier to entry.”).

19. KAHN, *supra* note 6, at 10–11.

20. See, e.g., Kades & Scott Morton, *supra* note 9, at 2 (“[W]e argue addressing entry barriers created by network effects is critical to remedying a monopolization violation in a social network market (e.g. Facebook). For a social network, interoperability is likely a necessary, but not necessarily a sufficient, condition for an effective remedy. Mandatory interoperability based on robust and effective rules could overcome the network effects that protect the incumbent from entry, maximizing the potential for new entrants to enter at minimal cost, compete in the market, and take share from the incumbent.”).

21. See, e.g., Lina M. Khan & David E. Pozen, *A Skeptical View of Information Fiduciaries*, 133 HARV. L. REV. 497, 539 (2019); William Boyd, *Public Utility and the Low-Carbon Future*, 61 UCLA L. REV. 1614, 1686 (2014); Lina M. Khan, *The Separation of Platforms and Commerce*, 119 COLUM. L. REV. 973, 980 (2019); Lina M. Khan, Note, *Amazon’s Antitrust Paradox*, 126 YALE L.J. 710, 797 (2017); William J. Novak, *The Public Utility Idea and the Origins of Modern Business Regulation*, in CORPORATIONS AND AMERICAN DEMOCRACY 139, 139–41 (Naomi R. Lamoreaux & William J. Novak eds., 2017); William J. Novak, *Law and the Social Control of American Capitalism*, 60 EMORY L.J. 377, 400 (2010). Nondiscrimination is often described as a third coordination requirement. See, e.g., Promoting Wholesale Competition Through Open Access Non-Discriminatory Transmission Services by Public Utilities, 61 Fed. Reg. at 21540. Clearinghouses and depositories can only provide open access and interoperability if they do not discriminate against their competitors. Thus, nondiscrimination requirements apply to the market participants we study in Part II, though they do not appear to have been as controversial as open access or interoperability.

22. See Complaint ¶¶ 4–9, United States v. Google LLC, No. 20-cv-03010 (D.D.C. Oct. 20, 2020).

23. Complaint for Injunctive and Other Equitable Relief ¶ 22, FTC v. Facebook, Inc., No. 20-cv-03590 (D.D.C. Jan. 13, 2021).

fewer than forty-eight states were considering legislation to expand access to broadband internet, many through open-access requirements.²⁴ Scholars have also argued for the adoption of open-access requirements for internet service providers (ISPs), financial institutions, and energy companies.²⁵ Should this movement gain momentum, we may find ourselves riding the crest of a new wave of public-utility regulation.

Given this prospect, we must seek to understand better the design, governance, and limits of the open-access and interoperability requirements that represent the cornerstones of this approach. To advance our understanding, this Article examines the historical impact of open-access and interoperability requirements in the context of two critical – yet critically understudied²⁶ – institutions at the heart of our financial-market infrastructure: securities clearinghouses and depositories.

Clearinghouses and depositories are the complex and opaque “plumbing” of global securities markets.²⁷ Clearinghouses collect securities-trading data, verify

24. See Heather Morton, *Broadband 2021 Legislation*, NAT’L CONF. STATE LEGISLATURES (Jan. 7, 2022), <https://www.ncsl.org/research/telecommunications-and-information-technology/broadband-2021-legislation.aspx> [<https://perma.cc/PT56-23Y8>].
25. See, e.g., LAWRENCE LESSIG, *THE FUTURE OF IDEAS* 34-48, 147-75 (2001); Ricks, *supra* note 6, at 770; Khan & Pozen, *supra* note 21, at 539; cf. Randal C. Picker, *Pursuing a Remedy in Microsoft: The Declining Need for Centralized Coordination in a Networked World*, 158 J. INST. & THEORETICAL ECON. 113, 114-15 (2002) (arguing that technological advances have reduced the need for centralized coordination).
26. The bulk of the existing literature on clearinghouses focuses on the use and effectiveness of various loss-mutualization mechanisms, the potential systemic risks arising from the failure of a clearinghouse, and the optimal scope of clearing mandates. See, e.g., Felix B. Chang, *The Systemic Risk Paradox: Banks and Clearinghouses Under Regulation*, 2014 COLUM. BUS. L. REV. 747 [hereinafter Chang, *Systemic Risk Paradox*]; Felix B. Chang, *Financial Market Bottlenecks and the “Openness” Mandate*, 23 GEO. MASON L. REV. 69 (2015) [hereinafter Chang, *Financial Market Bottlenecks*]; Yuliya Guseva, *Destructive Collectivism: Dodd-Frank Coordination and Clearinghouses*, 37 CARDOZO L. REV. 1693 (2016); Mark J. Roe, *Clearinghouse Overconfidence*, 101 CALIF. L. REV. 1641 (2013); Jeremy C. Kress, *Credit Default Swaps, Clearinghouses, and Systemic Risk: Why Centralized Counterparties Must Have Access to Central Bank Liquidity*, 48 HARV. J. ON LEGIS. 49 (2011); Richard Squire, *Clearinghouses as Liquidity Partitioning*, 99 CORNELL L. REV. 857 (2014); Paolo Saguato, *The Ownership of Clearinghouses: When “Skin in the Game” Is Not Enough, the Remutualization of Clearinghouses*, 34 YALE J. ON REGUL. 601 (2017); Paolo Saguato, *The Unfinished Business of Regulating Clearinghouses*, 2020 COLUM. BUS. L. REV. 449; David A. Wishnick, *Reengineering Financial Market Infrastructure*, 105 MINN. L. REV. 2379 (2021).
27. Ben S. Bernanke, Chairman, Bd. of Governors of the Fed. Rsrv. Sys., *Clearinghouses, Financial Stability, and Financial Reform*, Remarks at the 2011 Financial Markets Conference 1 (Apr. 4, 2011), <http://www.federalreserve.gov/newsevents/speech/bernanke20110404a.pdf> [<https://perma.cc/TLL8-RFA9>]; see also JOHN ARMOUR, DAN AWREY, PAUL DAVIES, LUCA ENRIQUES, JEFFREY N. GORDON, COLIN MAYER & JENNIFER PAYNE, *PRINCIPLES OF FINANCIAL REGULATION*

trade details, and coordinate the transfer of securities and funds between buyers and sellers.²⁸ Many clearinghouses also act as guarantors – standing between the parties on either side of a trade.²⁹ Securities depositories play a complementary role, holding securities on behalf of their owners and maintaining and continuously updating electronic records of their legal and beneficial ownership.³⁰

Securities clearinghouses and depositories are essential to the smooth, efficient, and resilient operation of modern financial markets.³¹ Indeed, it is no exaggeration to say that they are what make the scale and speed of modern finance possible. At the same time, the growing importance of these financial-market infrastructures has led to legitimate concerns about their systemic importance and market power.³² These concerns recently reached a fever pitch after long-standing rules imposed by the dominant U.S. securities clearinghouse temporarily forced the popular online trading platform Robinhood to suspend new buy orders in GameStop and several other popular “meme” stocks.³³ The aftermath has sparked public outcry, congressional hearings, and even a U.S. Securities and Exchange Commission (SEC) investigation.³⁴ It also revealed the enormous

408 (2016) (“Payment and settlement systems are the plumbing of the global financial system.”).

28. See Comm. on Payment & Settlement Sys., *A Glossary of Terms Used in Payments and Settlement Systems*, BANK FOR INT’L SETTLEMENTS 4 (Oct. 17, 2016), <https://www.bis.org/dcms/glossary/glossary.pdf?scope=CPMI&base=term> [<https://perma.cc/RD58-NX95>].
29. See *Financial Clearing Houses*, CFA INST., <https://www.cfainstitute.org/en/advocacy/issues/central-clearing-houses> [<https://perma.cc/PS52-68ME>].
30. See Comm. on Payment & Settlement Sys., *supra* note 28, at 3 (defining central securities depository).
31. See Bernanke, *supra* note 27, at 1-2.
32. See Roe, *supra* note 26, at 1644-45; Chang, *Systemic Risk Paradox*, *supra* note 26, at 749-52; Bernanke, *supra* note 27, at 1-2, 13.
33. See Matt Levine, Opinion, *Robinhood Had a Busy Week*, BLOOMBERG (Feb. 2, 2021, 12:02 PM EST), <https://www.bloomberg.com/opinion/articles/2021-02-02/gamestop-trade-was-a-mixed-bag-for-robinhood> [<https://perma.cc/82ET-JS3G>]; *Game Stopped? Who Wins and Loses When Short Sellers, Social Media, and Retail Investors Collide, Part III: Hearing Before the H. Comm. on Fin. Servs.*, 117th Cong. 72-74 (2021) (statement of Michael C. Bodson, Chief Executive Officer, Depository Trust & Clearing Corporation).
34. See Maggie Fitzgerald, *Here’s What to Expect from Thursday’s GameStop Hearing with Robinhood, Citadel and Reddit CEOs*, CNBC (Feb. 17, 2021, 8:03 PM EST), <https://www.cnbc.com/2021/02/17/gamestop-hearing-what-to-expect-from-robinhood-reddit-and-citadel.html> [<https://perma.cc/G628-X5MT>]; *Staff Report on Equity and Options Market Structure Conditions in Early 2021*, STAFF OF THE U.S. SEC. & EXCH. COMM’N (Oct. 14, 2021), <https://www.sec.gov/files/staff-report-equity-options-market-struction-conditions-early-2021.pdf> [<https://perma.cc/Q9SU-ARH4>]; Benjamin Bain & Daniel Avis, *SEC Hunts for Fraud in Social-Media Posts Hyping GameStop*, BLOOMBERG (Feb. 3, 2021, 3:16 PM EST), <https://www.bloomberg.com/news/articles/2021-02-03/sec-hunts-for-fraud-in-social-media-posts-that-drove-up-gamestop> [<https://perma.cc/R6WH-98NR>].

power wielded by an obscure but vital component of our financial-market infrastructure: the Depository Trust & Clearing Corporation (DTCC).

This Article sheds new light on how DTCC came to possess so much power over U.S. securities markets. Less than fifty years ago, American securities markets were supported by several regional clearinghouses and depositories, each connected to a regional stock exchange.³⁵ Today, a single firm—National Securities Clearing Corporation (NSCC)—is the only remaining clearinghouse,³⁶ while another—the Depository Trust Company (DTC)—is the only remaining depository.³⁷ Even more remarkably, both NSCC and DTC are owned by the same parent company: DTCC.³⁸

So, what happened? To answer this question, this Article provides the first detailed historical account of why these twin industries have become so highly concentrated. Intuitively, we might expect the answer to reflect the pronounced economies of scale and network effects associated with securities clearing and settlement.³⁹ However, while this is undoubtedly an important piece of the puzzle, the answer also stems from a series of 1975 amendments to the Securities Exchange Act of 1934 that, ironically, were designed to enhance competition in U.S. securities clearing and depository markets.⁴⁰ These amendments prohibited the SEC from granting NSCC and DTC monopolies over their respective industries. Instead, Congress ordered the SEC “to facilitate the establishment of

35. See *infra* Section II.C.

36. See *infra* Section II.C.

37. See *infra* Section II.C.

38. See *infra* Section II.B.

39. While there are multiple clearinghouses in the United States, each one controls virtually the entire market for the financial product it clears. See *Annual Report 2012*, FIN. STABILITY OVERSIGHT COUNCIL 145-87 (2012), https://fraser.stlouisfed.org/files/docs/historical/fct/treasury/treasury_fsoc_ar_2012.pdf [<https://perma.cc/ZX4M-J7TV>] (analyzing the systemic importance of U.S. clearinghouses); see also Chang, *Systemic Risk Paradox*, *supra* note 26, at 764 (“NSCC has been compared to a public utility, a common solution for natural monopoly” (emphasis omitted)); *Bradford Nat’l Clearing Corp. v. SEC*, 590 F.2d 1085, 1101 (D.C. Cir. 1978) (“NSCC is essentially a public utility that is afforded a monopoly but must offer its services to all qualified customers (its own participants or other clearing agencies) at cost.”); *National Securities Clearing Corp.: Order Granting Registration and Statement of Reasons*, Exchange Act Release No. 13163, 42 Fed. Reg. 3916, 3937 n.198 (Jan. 13, 1977) (“[E]ven in the absence of a determination that clearing and settlement operations are a natural monopoly, the Commission recognizes that at a future date new developments in clearing and settlement operations may warrant the performance of all or discreet portions of those operations by a single, cooperative organization.”).

40. See Securities Acts Amendments of 1975, sec. 15, § 17A(a)(2), 89 Stat. 97, 141 (codified at 15 U.S.C. § 78q-1(a)(2)(A)) (listing “competition among . . . clearing agencies” as one of the amendment’s principal goals).

a national system for the prompt and accurate clearance and settlement of transactions in securities.”⁴¹ In turn, the SEC ordered NSCC, DTC, and other clearing agencies to “establish full interfaces or appropriate links with the clearing agencies of designated regional exchanges.”⁴² Put simply: Congress and the SEC sought to use open-access and interoperability requirements to promote more vigorous competition.

Yet, less than thirty years later, NSCC and DTC were the last firms standing.⁴³ Rather than promoting greater competition, the SEC’s open-access and interoperability requirements did little to prevent the gradual consolidation of U.S. securities clearinghouse and depository markets. Even more remarkably, these requirements actually played an important role in paving DTCC’s unexpected path to monopoly. They did so in three ways.

First, the SEC’s coordination requirements failed to eliminate the need for each regional clearinghouse and depository to build and maintain the technological and operational connections that enabled them to access the new SEC-

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41. *See id.* (codified at 15 U.S.C. § 78q-1(a)(2)(A)(i)). In 1990, Congress further ordered the SEC “to facilitate the establishment of linked or coordinated facilities for clearance and settlement of transactions in securities.” Market Reform Act of 1990, Pub. L. No. 101-432, sec. 5, § 17A(a)(2), 104 Stat. 963, 973 (codified at 15 U.S.C. § 78q-1(a)(2)(A)(ii)).
 42. Larry E. Bergmann, Senior Assoc. Dir., Div. of Mkt. Regul., U.S. Sec. & Exch. Comm’n, Speech at the International Securities Settlement Conference: The U.S. View of the Role of Regulation in Market Efficiency (Feb. 10, 2004), <https://www.sec.gov/news/speech/spcho21004leb.htm> [<https://perma.cc/2KBX-JWVG>]. The term “clearing agency” is defined by statute. *See* 15 U.S.C. § 78c(a)(23)(A) (2018) (“The term ‘clearing agency’ means any person who acts as an intermediary in making payments or deliveries or both in connection with transactions in securities or who provides facilities for comparison of data respecting the terms of settlement of securities transactions, to reduce the number of settlements of securities transactions, or for the allocation of securities settlement responsibilities. Such term also means any person, such as a securities depository, who (i) acts as a custodian of securities in connection with a system for the central handling of securities whereby all securities of a particular class or series of any issuer deposited within the system are treated as fungible and may be transferred, loaned, or pledged by bookkeeping entry without physical delivery of securities certificates, or (ii) otherwise permits or facilitates the settlement of securities transactions or the hypothecation or lending of securities without physical delivery of securities certificates.”).
 43. *See DTCC Finally Puts DTC and NSCC on to a Single Platform After Six Months of Dual Running*, GLOB. CUSTODIAN (Jan. 14, 2004, 12:00 AM GMT), <https://www.globalcustodian.com/dtcc-finally-puts-dtc-and-nbcc-on-to-a-single-platform-after-six-months-of-dual-running> [<https://perma.cc/6E64-7QCF>] (“Through DTC [The Depository Trust Company] and NSCC, DTCC [The Depository Trust and Clearing Corporation] provides clearance and settlement services for virtually all trades done on the New York Stock Exchange [NYSE], Nasdaq and the American Stock Exchange [Amex], as well as on all regional exchanges and electronic communications networks . . . in the United States.”).

mandated market infrastructure. The high fixed costs of building these connections placed a disproportionate burden on smaller firms, putting them at a competitive disadvantage.⁴⁴

Second, the SEC's coordination requirements enabled larger firms like NSCC and DTC to dictate the direction and pace of their rivals' technological innovation. Whenever NSCC and DTC introduced technological improvements to their clearing and depository systems, the SEC's coordination requirements effectively forced their regional competitors to make enormous infrastructure investments to ensure their own systems' technological and operational compatibility.⁴⁵ This, in turn, contributed to market consolidation, since whenever NSCC and DTC introduced improvements to their systems the regional clearinghouses and depositories had to follow suit—and to bear the substantial costs of building better, faster, and more resilient clearing and depository systems. In the face of these potentially enormous costs, each smaller regional player would eventually sell or otherwise cede control of its clearing and depository businesses to NSCC and DTC.⁴⁶

Lastly, coordination requirements prevented firms from differentiating their clearing and depository services from those of their competitors. Because the interoperable interfaces mandated by the SEC envisioned that brokerage firms would be able to process trades that involved more than one clearinghouse or depository, each clearinghouse and depository was effectively forced to rely on the systems developed by their competitors.⁴⁷ In practice, this meant that the smaller regional players had no choice but to rely on the systems built by NSCC and DTC.⁴⁸ This ultimately undercut the ability of these regional players to compete with NSCC and DTC because their only path to profitability was to layer additional processes—and costs—on top of those already built by their larger rivals. For this reason, open access and interoperability quickly morphed into a form of outsourcing that resulted in firms offering virtually identical services.

The SEC's open-access and interoperability requirements were not the only drivers of consolidation in U.S. securities clearing and depository markets. The competitive dynamics described in this Article played out in parallel with other seismic changes within the U.S. securities industry. These changes included the

44. See *infra* Section II.C.

45. See *infra* Section II.C.

46. See *infra* Section II.C.

47. See *infra* Section II.C.

48. This might have occurred because of high infrastructure costs or because the interfaces were poorly designed. Either way, once regional clearinghouses and depositories developed interfaces with NSCC and DTC, they used the infrastructure NSCC and DTC had constructed to execute most trades. See *infra* Sections II.C.2-3.

elimination of fixed-brokerage commissions, the introduction of the National Market System, the changing ownership structure and governance of U.S. stock-exchange groups, and a technological revolution in trade execution.⁴⁹ Nevertheless, the consolidation of U.S. securities clearing and depository markets and the rise of DTCC—against the backdrop of the SEC’s open-access and interoperability requirements—represents an important and previously untold chapter within this broader story.

This chapter has implications well beyond the narrow and hypertechnical world of financial-market infrastructure. The first implication is for financial regulation. As a threshold matter, our analysis helps to explain how and why two of the most critical components of our financial-market infrastructure became too big to fail. Granted, securities clearinghouses and depositories likely would have been systemically important regardless of the prevailing level of industry consolidation.⁵⁰ Yet the exit of the regional clearinghouses and depositories left U.S. securities markets without any competitors that could theoretically absorb the business of NSCC or DTC in the event of their financial distress. Viewed in this light, the SEC’s open-access and interoperability requirements have contributed to a lack of substitutability, leaving policymakers with few options other than public ownership or a taxpayer-funded bailout should NSCC and DTC ever find themselves on the brink of failure.⁵¹

49. For a discussion of these other developments, see, for example, MERRITT B. FOX, LAWRENCE R. GLOSTEN & GABRIEL V. RAUTERBERG, *THE NEW STOCK MARKET: LAW, ECONOMICS, AND POLICY* 13-19 (2019), which describes the evolution of the modern stock market; Gregg A. Jarrell, *Change at the Exchange: The Cause and Effects of Deregulation*, 27 J.L. & ECON. 273, 275-284 (1984), which describes and evaluates the elimination of fixed brokerage commissions; Norman Poser, *Restructuring the Stock Markets: A Critical Look at the SEC’s National Market System*, 56 N.Y.U. L. REV. 883, 896-913 (1981), which reviews and assesses the early development of the National Market System; Reena Aggarwal, *Demutualization and Corporate Governance of Stock Exchanges*, 15 J. APPLIED CORP. FIN. 105, 105-07 (2002), which describes the evolving ownership structure and governance of exchanges; and Maureen O’Hara & Alfredo Mendiola, *Taking Stock in Stock Markets: The Changing Governance of Exchanges* 3-8 (Aug. 2003) (unpublished manuscript), <https://ssrn.com/abstract=431580> [<https://perma.cc/UGZ8-RQFG>], which discusses the causes and effects of the shift to publicly traded exchanges.

50. Clearinghouses and depositories provide vital infrastructure and, as the Financial Stability Oversight Council acknowledged in designating these firms as systemically important financial-market utilities, their failure would be catastrophic. See *Annual Report 2012*, *supra* note 39, at 145-87. Still, financial institutions can become too big to fail even when they have competitors. See Jeremy Kress & Matthew Turk, *Too Many to Fail: Against Community Bank Deregulation*, 115 NW. U. L. REV. 647, 651 (2020) (describing how community-bank deregulation creates a “too-many-to-fail” issue in which “community banks tend to fail en masse due to their highly correlated balance sheets and funding strategies”).

51. See *infra* Section III.A.

The second implication relates to the potential impact of open-access and interoperability requirements on competition. By lowering high fixed costs and other barriers to entry, these requirements are designed to foster greater competition—and with it, greater dynamism and innovation in the development of new products and services. However, where the design and implementation of these requirements effectively force competitors to rely on the infrastructure developed by their rivals, this can severely limit the scope for meaningful product differentiation. Where this is the case, open-access and interoperability requirements will not only fail to promote greater competition and innovation but may actually hand the market to the firms that control the infrastructure through which their competitors must offer their products.⁵²

The third and final implication relates to the design, governance, and limits of open-access and interoperability requirements as an alternative to traditional antitrust remedies. In theory, the benefits of interoperability stem from the coordinated allocation of the high, largely fixed, and potentially duplicative costs of developing, maintaining, and accessing common market infrastructure.⁵³ However, our analysis suggests that where these costs are not readily divisible or actually divided, or where the division of costs places a disproportionate burden on smaller firms, then interoperability is unlikely to forestall monopoly control. Accordingly, while legally mandated interoperability is often touted as an alternative to both regulated monopoly and the breakup of dominant firms, in practice it can have significant anticompetitive effects. Mitigating these effects requires careful thought about not only the *allocation* of these costs, but also the *governance* of decisions regarding the direction, timing, and size of new infrastructure investments. This insight offers a cautionary tale—and a potential roadmap—for policymakers seeking to employ open-access and interoperability requirements to constrain growing market power in Big Tech, social media, finance, and elsewhere.⁵⁴

This is not to suggest that open-access and interoperability requirements will always generate anticompetitive effects. While in the case of U.S. securities clearing and depository markets they served to concentrate market power in the

52. See *infra* Section III.B.

53. For a related analysis, see *MCI Commc'ns Corp. v. AT&T*, 708 F.2d 1081, 1094 n.12 (7th Cir. 1983) (“The general service carriers argued that the entry of specialized common carriers into the telecommunications industry would be contrary to the public interest because telecommunications services could be provided more economically by a single supplier; because additional microwave systems would be duplicative and wasteful; and because specialized carriers without general service responsibilities would ‘cream-skim’ the existing averaged rate structure by selectively competing only along the most profitable long distance routes, thus imposing a heavier rate burden on low density and local telephone users.”).

54. See *infra* Section III.B.

hands of NSCC and DTC, in other markets they have offered a viable alternative to monopoly.⁵⁵ Rather, our analysis suggests that where the costs of building a platform, network, or other infrastructure cannot be effectively allocated across competing firms, the use of these requirements as an alternative to monopoly control may, in fact, exacerbate the very problems they were designed to address. Whether this outcome is desirable depends on whether it is preferable to organize a given industry as a monopoly. The point is not simply that the anticompetitive effects of open access and interoperability can be harmful. It is that the tradeoff between economies of scale and market power is sometimes unavoidable.

In this vein, our analysis also suggests a qualified defense of open access and interoperability even where they fail to forestall monopoly control.⁵⁶ Specifically, where there is uncertainty about whether a particular market is a natural monopoly, well-designed open-access and interoperability requirements might offer a mechanism that can reveal the optimal market structure. Simultaneously, even where these requirements do not initially prevent the emergence of a monopoly, they maintain the threat that new firms might one day enter the market, access the common infrastructure, and use it to offer superior products and services. This threat can spur ongoing investment and innovation by monopolists, thereby reducing – if not necessarily eliminating – monopoly rents.

We live in an interconnected world. Just as the nineteenth-century economy was built around railroads and the twentieth century around power, telecommunications, and international trade, so, too, will the twenty-first century be shaped by the emergence and growth of new networks, including online marketplaces, finance, social media, and Big Tech. In theory, open-access and interoperability requirements can help to prevent the concentration of market power in these network industries, thereby promoting greater competition and innovation. In practice, however, the design and implementation of these requirements are critical to their success. Poorly designed open-access and interoperability requirements will not only fail to achieve these important objectives but might exacerbate the very problems they are designed to address.

This Article proceeds in three Parts. Part I describes the conventional wisdom that open-access and interoperability requirements can replicate the economies of scale typically associated with a monopoly without handing control over an entire industry to a single firm. Part II traces the untold history of U.S. securities clearing and depository markets, describes the SEC's open-access and interoperability requirements, and chronicles DTCC's slow and steady march toward monopoly. Part III considers the potential policy implications of our analysis for

55. See *infra* Section I.C.

56. See *infra* Section III.C.

financial stability and the design of open-access and interoperability requirements; it also assesses the potential benefits of these requirements compared with both regulated monopoly and the forced breakup of dominant firms.

I. COORDINATION, NOT CONSOLIDATION

Natural monopolies require policymakers to thread a thin needle. On the one hand, in markets characterized by significant economies of scale, scope, or network effects, industry fragmentation typically leads to higher costs. In many cases, these higher costs suggest that the market would be best served by a single firm.⁵⁷ On the other hand, once a single firm comes to enjoy a monopoly, it may abuse its dominant position, face insufficient incentives to innovate, and become too big to fail. This Part describes the regulatory challenges posed by natural monopoly and the range of regulatory tools that policymakers have conventionally used to address these challenges.

A. *The Problems of Monopoly*

Scholars have long warned of the economic problems that can arise when a monopolist controls an entire industry.⁵⁸ The first problem stems from the fact that monopolists have both powerful incentives and the unilateral ability to raise prices and restrict supply.⁵⁹ The issue here is not simply that monopolists increase the price of goods and services, but that monopoly leads to an inefficient

57. As Richard A. Posner has explained, the phrase “natural monopoly”

does not refer to the actual number of sellers in a market but to the relationship between demand and the technology of supply. If the entire demand in the relevant market can be satisfied at lowest cost by one firm rather than by two or more, the market is a natural monopoly, whatever the number of firms in it.

Richard A. Posner, *Natural Monopoly and Its Regulation*, 21 STAN. L. REV. 548, 548 (1969).

58. Adam Smith offered an early and eloquent critique:

The member of parliament who supports every proposal for strengthening this monopoly, is sure to acquire not only the reputation of understanding trade, but great popularity and influence with an order of men whose numbers and wealth render them of great importance. If he opposes them, on the contrary, and still more if he has authority enough to be able to thwart them, neither the most acknowledged probity, nor the highest rank, nor the greatest public services, can protect him from the most infamous abuse and detraction, from personal insults, nor sometimes from real danger, arising from the insolent outrage of furious and disappointed monopolists.

¹ ADAM SMITH, AN INQUIRY INTO THE NATURE AND CAUSES OF THE WEALTH OF NATIONS 436 (Edwin Cannan ed., Methuen & Co. 1963) (1776).

59. See Posner, *supra* note 57, at 551-53.

level of production from a societal perspective. This is the classic problem of monopoly power, where a shortage arises as the monopolist reduces output and raises prices.⁶⁰

The second problem is that monopoly control often results in less innovation. This can be the case both because monopolists themselves have weak incentives to innovate and because they stand to benefit from engaging in anti-competitive conduct that stifles innovation by other firms.⁶¹ There are several reasons that might explain why monopolists lack incentives to innovate. According to one theory, developed by economist Kenneth J. Arrow, innovation generates fewer rewards when output is restricted.⁶² More specifically, if it is costly to develop a new product, a rational monopolist that restricts output can only spread (or amortize) those costs across the reduced units of production.⁶³ As Arrow also observed, an incumbent has weaker incentives to innovate than a new entrant when the potential new product overlaps with its existing portfolio of products.⁶⁴ In effect, while new entrants are induced by the prospect of capturing an incumbent's market share, incumbents might be concerned that an innovative new product would cannibalize demand for its existing products.

Of course, market concentration will not always reduce an incumbent's incentives to innovate.⁶⁵ Innovations that lower costs can increase an incumbent's

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60. Regardless of whether it is preferable for consumers or sellers to receive the surplus, society is worse off when the monopolist restricts supply and raises prices. *See id.* at 550-51 (describing inefficiencies).
61. *See* Jeffrey A. Rosen, Deputy Att'y Gen., U.S. Dep't of Just., Deputy Attorney General Jeffrey A. Rosen Speaks at the Free State Foundation's 12th Annual Telecom Policy Conference (Mar. 10, 2020), <https://www.justice.gov/opa/speech/deputy-attorney-general-jeffrey-rosen-speaks-free-state-foundations-12th-annual-telecom> [<https://perma.cc/PTB4-LJNH>]; Giulio Federico, Fiona Scott Morton & Carl Shapiro, *Antitrust and Innovation: Welcoming and Protecting Disruption* 3-4, 24 (Nat'l Bureau of Econ. Rsch., Working Paper No. 26005, 2019), <https://www.nber.org/papers/w26005.pdf> [<https://perma.cc/VNA2-GVPH>]. *But cf.* Harold Demsetz, *Industry Structure, Market Rivalry, and Public Policy*, 16 J.L. & ECON. 1, 3 (1973) (arguing that short-term monopoly power can arise from superior entrepreneurship and that "[t]o destroy such power when it arises may very well remove the incentive for progress"); Richard J. Gilbert & David M. G. Newbery, *Preemptive Patenting and the Persistence of Monopoly*, 72 AM. ECON. REV. 514, 516 (1982) (using a formal model to argue that, under certain conditions, "monopolist[s] will spend more on [research and development] than rival firms").
62. *See* Kenneth J. Arrow, *Economic Welfare and the Allocation of Resources for Invention*, in THE RATE AND DIRECTION OF INVENTIVE ACTIVITY: ECONOMIC AND SOCIAL FACTORS 609, 616-19 (Richard R. Nelson ed., 1962).
63. *See id.* at 619-22.
64. *See id.*; *see also* Thomas J. Holmes, David K. Levine & James A. Schmitz Jr., *Monopoly and the Incentive to Innovate When Adoption Involves Switchover Disruptions*, 4 AM. ECON. J.: MICROECONOMICS 1, 2 (2012) (providing an extension of Kenneth J. Arrow's model).
65. *See* Arrow, *supra* note 62, at 619.

profit margins and many successful incumbents have made substantial investments in new technology.⁶⁶ Famous examples include Verizon’s decision to build a 5G wireless network, Intel’s repeated innovations in microprocessor technology, Boeing’s ongoing development of a fleet of commercial aircraft, and numerous pharmaceutical discoveries.⁶⁷ Yet, in each of these cases, it was the *threat* of competition that encouraged monopolists to invest in innovation.⁶⁸ In contrast, firms that are completely shielded from competition, such as electric utilities that enjoy a legal right to a monopoly, have historically made virtually no investments in innovative research and development.⁶⁹ More broadly, incumbents in all markets have an incentive to use anticompetitive strategies to acquire, build, and protect their market share.⁷⁰ For example, incumbents often undertake so-called “killer acquisitions” with the intention of shuttering the target firm’s operations, preventing nascent competitors from bringing their products to market, and thus protecting their dominant market position.⁷¹

66. See Federico et al., *supra* note 61, at 1-2.

67. See *id.* at 1-2, 6.

68. See *id.* at 2 (“[I]nnovation is best promoted when market leaders are allowed to exploit their competitive advantages while also facing pressure to perform coming from both conventional rivals and from disruptive entrants.”).

69. See Marilyn Waite, *Why US Utilities Should Invest in Innovation*, UTIL. DIVE (Apr. 24, 2017), <https://www.utilitydive.com/news/why-us-utilities-should-invest-in-innovation/441114> [<https://perma.cc/B9ZT-E2GL>] (“The research and development (R&D) budgets of U.S. electric utilities – both [publicly owned utilities] and [investor-owned utilities] – tend to be slim, and in many cases near zero. Historically, the maximum that an electric utility in the United States would spend on R&D is 1% of its revenue – but . . . most investor-owned utilities spend 0% . . .” (emphasis omitted)).

70. See Fiona M. Scott Morton, *Reforming U.S. Antitrust Enforcement and Competition Policy*, WASH. CTR. FOR EQUITABLE GROWTH (Feb. 18, 2020), <https://equitablegrowth.org/reforming-u-s-antitrust-enforcement-and-competition-policy> [<https://perma.cc/AAS5-D48C>] (“[F]irms have a financial incentive to restrain competition in order to obtain monopoly profits. There are three main harmful methods of limiting competition: colluding with rivals in a market, merging with rivals or potential rivals, and using anticompetitive techniques to exclude existing or potential entrants.”). The Sherman Act prohibits such conduct. See 15 U.S.C. § 2 (2018) (criminalizing the monopolization of “any part of the trade or commerce among the several States, or with foreign nations”).

71. See Colleen Cunningham, Florian Ederer & Song Ma, *Killer Acquisitions*, 129 J. POL. ECON. 649, 696 (2021) (describing the practice of “acquir[ing] innovative targets and terminat[ing] their innovative projects in order to preempt future competition”). One might think that the prospect of “killer acquisitions” would, in some cases, encourage innovation, as prospective competitors stand to benefit from a handsome payout when the incumbent tries to acquire them. There is evidence, however, that this does not always occur. See Sai Krishna Kamepalli, Raghuram Rajan & Luigi Zingales, *Kill Zone 2* (Nat’l Bureau of Econ. Rsch., Working Paper No. 27146, 2022), https://www.nber.org/system/files/working_papers/w27146/w27146.pdf [<https://perma.cc/UM4F-G34T>] (demonstrating that acquisitions by Google or Facebook in

The third problem stems from the possibility that monopolists might become systemically important. Where the products supplied by a monopolist are viewed as essential to the smooth and efficient functioning of an economy, the failure of these firms can have enormous consequences for society. For this reason, when these firms experience financial distress, policymakers face a difficult choice: either allow these firms to fail or provide them with the financial support necessary to continue providing their socially indispensable products. This is the essence of the “too big to fail” problem that received widespread attention in the wake of the 2008 financial crisis, when the systemic importance of a small handful of financial institutions created the perception – and, in some cases, the reality – that the government would be forced to bail them out rather than risk their failure, which would destabilize the financial system and wreak havoc on the broader economy.⁷²

The too-big-to-fail problem imposes a number of costs on society. First, the expectation that a firm is too big to fail generates moral hazard. The expectation that a government will bail out a firm undercuts its creditors’ incentives to monitor the firm’s capital structure, business decisions, and overall financial health. The resulting lack of oversight can give the firm’s managers free rein to take socially excessive risks.⁷³ Second, and compounding matters, the expectation that creditors will be able to shift risk to the government during periods of financial distress will often lower the cost of financing for too-big-to-fail firms.⁷⁴ In effect, if a firm’s creditors expect the government to bail them out, they will be willing to lend the firm money at lower interest rates.⁷⁵ Viewed in this light, the too-big-to-fail problem is yet another source of competitive distortions: it gives systemically important firms access to capital at a lower price than is available to their smaller competitors. This, in turn, further entrenches their systemic importance, enabling already-dominant firms to increase their market share.⁷⁶

a certain industry sector reduce venture-capital investment in that sector by forty percent and deal volume by twenty percent). In industries that have significant network effects, the prospect of killer acquisitions reduces the likelihood that the project will develop a large-enough user base to become viable. There is evidence that investors are aware of this fact and therefore reluctant to provide capital to firms that would compete with dominant platforms. See Kamepalli et al., *supra*, at 3.

72. See *Too Big to Fail: Expectations and Impact of Extraordinary Government Intervention and the Role of Systemic Risk in The Financial Crisis: Hearing Before the Fin. Crisis Inquiry Comm’n* 8–9 (Sept. 2, 2010) (statement of Ben S. Bernanke, Chairman, Board of Governors of the Federal Reserve System).
73. See *id.* at 9.
74. See Mark J. Roe, *Structural Corporate Degradation Due to Too-Big-to-Fail Finance*, 162 U. PA. L. REV. 1419, 1426 (2014).
75. See *id.* at 1446.
76. See *id.* at 1422.

In sum, monopoly – and industry concentration more generally – can be inefficient in both static and dynamic equilibrium. Monopolists often have both the incentive and ability to engage in abusive pricing and other anticompetitive practices. Monopolists will also often lack an incentive to innovate, while simultaneously possessing strong incentives to ensure that their competitors' innovations never make it into the marketplace.⁷⁷ Lastly, when an industry is systemically important, the existence of a monopoly will increase the likelihood that the government will be compelled to bail out a failing monopolist, generating further competitive distortions.

B. The Impact of Scale Economies and Network Effects

The problems of monopoly exist wherever a single firm supplies an entire market. However, the appropriate regulatory response often depends on whether a particular market is characterized by significant economies of scale. Scale economies exist when the average unit costs of producing a product *decrease* as the volume of production *increases*.⁷⁸ These scale economies are often observed in industries with large network effects. Network effects exist when the introduction of *new* users to a network increases the value of the network to *existing* users.⁷⁹ Consider social-media networks. The users of Facebook, Twitter, or Instagram are more likely to use these networks if their friends do because they will be able to connect with more of their friends on a single platform.⁸⁰ Importantly, this also makes these users less likely to switch to new networks if they do not already know a critical mass of friends who use a competitor's platform.⁸¹ Viewed from this perspective, both economies of scale and network effects give larger firms a comparative advantage over their smaller rivals.

77. See Arrow, *supra* note 62, at 619 (explaining why monopolists lack the incentives to invest in innovation); Holmes et al., *supra* note 64, at 1, 2 (describing how switchover disruptions reduce monopolists' incentive to innovate).

78. See Holmes et al., *supra* note 64, at 11.

79. See Paul Klemperer, *Network Goods (Theory)*, in 5 THE NEW PALGRAVE DICTIONARY OF ECONOMICS 915, 915 (Steven N. Durlauf & Lawrence E. Blume eds., 2d ed. 2008).

80. See Justus Haucap & Ulrich Heimeshoff, *Google, Facebook, Amazon, eBay: Is the Internet Driving Competition or Market Monopolization?*, 11 INT'L ECON. & ECON. POL'Y 49, 51 (2014) (discussing network effects in social-media networks and other online platforms).

81. See Michael L. Katz & Carl Shapiro, *Systems Competition and Network Effects*, 8 J. ECON. PERSPS. 93, 108 (1994).

This comparative advantage intersects with the concept of natural monopoly.⁸² Natural monopolies are often observed in industries characterized by high fixed costs of production. The delivery of some products—for example, fiber-optic cable networks, electric-transmission infrastructure, and gas pipelines—requires large upfront investments.⁸³ But once upfront investments are made, the relevant products—for example, internet access, electricity, and gas—often can be supplied at little or no marginal cost, with the result that the average unit cost declines as production expands. This gives large incumbent firms two additional advantages. First, unlike incumbents, new entrants would theoretically need to make the large upfront investments necessary to build this infrastructure from the ground up.⁸⁴ Second, even if aspiring new entrants made these investments, their smaller size would almost inevitably translate into higher average costs, still leaving them at a competitive disadvantage. This bleak calculus can erect significant barriers to entry, thereby discouraging new entrants and propelling an industry toward monopoly.

These industries pose unique policy challenges. Perhaps most importantly, policymakers face potentially significant tradeoffs when attempting to apply traditional antitrust remedies. For example, while creating a regulated monopoly would allow a monopolist to take advantage of economies of scale and network effects, it comes at the expense of future competition and innovation and raises the prospect that the monopolist might abuse its market power. Conversely, while breaking up dominant firms may curb market-power abuses, it would also prevent firms from fully capturing the efficiency benefits of scale and network

82. Natural monopolies refer to markets in which there are cost advantages associated with size. See Posner, *supra* note 57, at 584. They are generally characterized by declining average costs. See Ronald R. Braeutigam, *Optimal Policies for Natural Monopolies*, in 2 HANDBOOK OF INDUSTRIAL ORGANIZATION 1289, 1292 (Richard Schmalensee & Robert D. Willig eds., 1989). Economists refer to this condition as subadditivity, which describes a market where costs are lower when one firm controls all production. See Braeutigam, *supra*, at 1294-96.

83. See Chang, *Financial Market Bottlenecks*, *supra* note 26, at 80-81.

84. See Posner, *supra* note 57, at 570 (“Natural monopoly refers to a market whose entire demand can be met at lowest cost by a single firm. This implies that before a firm can begin to do business it must sink large sums in a plant that is large enough or can readily be expanded to serve the entire market. Once the heavy initial fixed or overhead expenses are incurred, the cost of serving a particular customer is relatively slight.”); Paul L. Joskow, *Regulation of Natural Monopoly*, in 2 HANDBOOK OF LAW AND ECONOMICS 1227, 1334 (A. Mitchell Polinsky & Steven Shavell eds., 2007) (“[T]he entrant may be able and willing inefficiently to bypass the incumbent’s network if the access price is greater than its own cost of duplicating the network.”).

effects. And while imposing monetary penalties on a firm for engaging in a “conspiracy” to obtain a monopoly position⁸⁵ might work in some contexts, this remedy will be wholly ineffective where a firm’s dominant position stems from lower production costs rather than corporate skullduggery. Moreover, monetary penalties will not deter future anticompetitive behavior where a monopolist can simply pass the associated costs onto consumers.⁸⁶

In industries characterized by pronounced economies of scale and network effects, policymakers thus face understandable pressure to permit high levels of industry concentration. But doing so almost inevitably leaves these industries vulnerable to all the problems of monopoly power. To avoid the Hobson’s choice between regulated monopoly and enforced breakup, policymakers have often invoked a different regulatory strategy: coordination requirements such as open access and interoperability.

C. *Alternatives to Breakup*

In markets characterized by pronounced economies of scale or network effects, policymakers have historically eschewed the breakup of dominant firms in favor of strict regulatory oversight.⁸⁷ One common regulatory strategy is rate regulation, whereby a regulator closely manages the price and quality of products that dominant firms provide.⁸⁸ Rate regulation is designed to replicate the outcome that would prevail in a less concentrated industry by requiring firms to provide the same level of output, at the same price, as they would in a more

85. See 15 U.S.C. § 1 (2018) (prohibiting “[e]very . . . conspiracy . . . in restraint of trade or commerce among the several States” and providing for monetary penalties).

86. See Joe Daniel, Sandra Sattler, Ashtin Massie & Mike Jacobs, *Used, But How Useful? How Electric Utilities Exploit Loopholes, Forcing Customers to Bail Out Uneconomic Coal-Fired Power Plants*, UNION OF CONCERNED SCIENTISTS 8 (May 2020), <https://www.ucsusa.org/sites/default/files/2020-05/Used%20but%20How%20Useful%20May%202020.pdf> [https://perma.cc/7875-5F69] (explaining how the uneconomic dispatch of coal-fired generators increases customer costs and keeps coal plants online); Joshua C. Macey, *Zombie Energy Laws*, 73 VAND. L. REV. 1077, 1107-11 (2020) (same).

87. Scholars, policymakers, and judges have also articulated a variety of rationales for eschewing breakups that are ostensibly unrelated to economies of scale and network effects. See Rory Van Loo, *In Defense of Breakups: Administering a “Radical” Remedy*, 105 CORNELL L. REV. 1955, 1961-72 (2020) (describing the skepticism about breakups among antitrust scholars, regulators, and judges).

88. See KAHN, *supra* note 6, at 4-7.

competitive market.⁸⁹ Scholars have given considerable attention to the rationale, design, and impact of rate regulation in various industries.⁹⁰ This Article focuses on two other regulatory strategies that policymakers have used to mitigate market-power abuses in these industries: open-access and interoperability requirements.⁹¹

The concepts of open access and interoperability have considerable overlap but are analytically distinct. Interoperability describes strategies whereby firms, voluntarily or by mandate, coordinate with each other to ensure the compatibility of substitutable or complementary products. The international standards for shipping containers are an illustrative example.⁹² Today, most shipping containers, regardless of their origin or manufacturer, are designed to be the same shape and size so they can be easily stacked one on top of another.⁹³ This common design increases the efficiency with which containers can be loaded onto a vessel, allows more cargo to be transported at a time, and eliminates the need to remove and repack the contents of the container when cargo is moved from one vessel to another.⁹⁴

One species of interoperability requirements—interconnection requirements—compels firms to build, maintain, and connect to common infrastructure through which their products are provided. The Interstate Commerce Act,

89. Another option that has received significant attention in recent years is to require “structural separations,” that is, to prohibit platforms from operating in certain related markets. *See, e.g.,* OECD, *Recommendation of the Council Concerning Structural Separation in Regulated Industries*, OECD Doc. LEGAL/0310 (Feb. 22, 2016), <https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0310> [<https://perma.cc/2H8C-Y9KM>].

90. *See, e.g.,* Harvey Averch & Leland L. Johnson, *Behavior of the Firm Under Regulatory Constraint*, 52 AM. ECON. REV. 1052, 1052 (1962). For important economic work building on Averch and Johnson’s theory, see William J. Baumol & Alvin K. Klevorick, *Input Choices and Rate-of-Return Regulation: An Overview of the Discussion*, 1 BELL J. ECON. & MGMT. SCI. 162, 162–63 (1970); and Alvin K. Klevorick, *The Behavior of a Firm Subject to Stochastic Regulatory Review*, 4 BELL J. ECON. & MGMT. SCI. 57, 57–60 (1973).

91. Rate regulation and open-access and interoperability requirements are not mutually exclusive—they can be used in combination. *See, e.g.,* Promoting Wholesale Competition Through Open Access Non-Discriminatory Transmission Services by Public Utilities, 61 Fed. Reg. 21540, 21692–95 (Apr. 24, 1996) (codified at 18 C.F.R. pts. 35, 385) (imposing coordination requirements on transmission providers). A third concept, nondiscrimination, is a close cousin of open access. *See, e.g., id.* at 21694 (imposing nondiscrimination requirements on transmission providers).

92. *See General Purpose Containers*, INT’L ORG. FOR STANDARDIZATION, <https://www.iso.org/ics/55.180.10/x/> [<https://perma.cc/LT7L-FXQD>] (listing the International Organization for Standardization’s standards for general-purpose containers).

93. *See* MARC LEVINSON, *THE BOX: HOW THE SHIPPING CONTAINER MADE THE WORLD SMALLER AND THE WORLD ECONOMY BIGGER* 4 (2006).

94. *See id.* at 10–11.

for example, requires common railroad carriers to “construct, maintain, and operate” switches connecting their tracks to those of other railroads.⁹⁵ Importantly, as this example illustrates, these interconnection requirements demand a threshold level of interoperability. There would be no practical use in mandating interconnections between the standard gauge (56.5 inch) tracks used for commercial freight and passenger traffic with the HO gauge (16.5 millimeter) tracks used for many model railroads.⁹⁶ Accordingly, while regulators can require interoperability without interconnection, they cannot require interconnection without also ensuring a minimum level of interoperability.

Open access, by contrast, refers to regulatory strategies designed to ensure that new entrants enjoy nondiscriminatory access to existing platforms and other infrastructure. A recent example of the use of this strategy is the now-repealed net-neutrality rules of the Federal Communications Commission (FCC). These rules, which prohibited ISPs from providing preferential treatment to some users, were designed to create an open-access regime for the internet.⁹⁷

While open access and interoperability often go hand in hand, it is possible for a firm, network, or industry to provide open access but not interoperability (and vice versa). For example, an electric-transmission company may agree to provide open access to all electricity generators while also refusing to build transmission lines that could be integrated with regional grid infrastructure.⁹⁸ Conversely, a group of tech companies could agree to integrate their operating systems while simultaneously excluding or disfavoring common rivals.⁹⁹ In this case, although the tech companies will have pursued an interoperability strategy, they will not have ensured open access.

95. Hepburn Act, ch. 3591, § 1, 34 Stat. 584, 585 (June 29, 1906) (amending the Interstate Commerce Act).

96. See *Standard Gauge*, ENCYCLOPEDIA BRITANNICA, <https://www.britannica.com/technology/standard-gauge> [https://perma.cc/CF5W-4542]; *HO Scale 1:87*, GOLD RUSH BAY, <https://www.goldrushbay.com/collections/ho-scale-1-87> [https://perma.cc/998A-484X].

97. See *Protecting and Promoting the Open Internet*, 30 FCC Rcd. 5601, 5603, ¶ 4 (2015) (adopting “carefully-tailored rules that would prevent specific practices we know are harmful to Internet openness—blocking, throttling, and paid prioritization—as well as a strong standard of conduct designed to prevent the deployment of new practices that would harm Internet openness”). The Federal Communications Commission (FCC) repealed the net-neutrality rules in 2017. See *Restoring Internet Freedom*, 33 FCC Rcd. 311, 312-13 (2017).

98. See *Promoting Wholesale Competition Through Open Access Non-Discriminatory Transmission Services by Public Utilities*, 61 Fed. Reg. 21540 (Apr. 24, 1996) (codified at 18 C.F.R. pts. 35, 385) (imposing coordination requirements but not requiring transmission providers to undertake regional transmission planning needed to support a more interconnected grid).

99. See Daisuke Wakabayashi & Jack Nicas, *Apple, Google and a Deal that Controls the Internet*, N.Y. TIMES (Oct. 25, 2020), <https://www.nytimes.com/2020/10/25/technology/apple-google-search-antitrust.html> [https://perma.cc/TP5A-4ZNX].

Policymakers have long used open-access and interoperability requirements to replicate scale economies and network effects, and regulators have deployed these requirements in a wide range of network industries. For example, the National Bank Act of 1863,¹⁰⁰ which created a uniform national currency,¹⁰¹ can be understood as applying open access and interoperability to money creation and payments.¹⁰² In the 1880s, Congress established the Interstate Commerce Commission to ensure that railroads provided nondiscriminatory service to customers.¹⁰³ And throughout the twentieth century, regulators relied on open access and interoperability to regulate natural gas, electricity, telecommunications, and airlines.¹⁰⁴

Even when regulators began introducing competition to network industries, they continued to rely on open access and interoperability to prevent natural monopolists from abusing their market power. In 1982, for example, DOJ entered into a consent decree with AT&T in which the Bell System agreed to provide its competitors access to its long-distance telephone network.¹⁰⁵ In 1985, when regulators tried to open natural-gas markets to competition, they ordered pipelines—which at the time were thought to be natural monopolists—to provide

100. National Bank Act of 1863, ch. 58, 12 Stat. 665.

101. *See id.* § 20, 12 Stat. at 670.

102. *See* Lev Menand & Morgan Ricks, *Federal Corporate Law and the Business of Banking*, 88 U. CHI. L. REV. 1361, 1386-87 (2021) (“[The National Bank Act] forced national banks to function as an integrated, horizontally networked system rather than as a mere collection of standalone enterprises. . . . It required national banks to receive each other’s notes at par and required the federal government to do the same. . . . To ensure that national bank notes would trade at par in every corner of the country, it mandated that national banks in remote locales maintain correspondent banking relations with national banks in population centers.”).

103. *See* Interstate Commerce Act, ch. 104, §§ 2-22, 24 Stat. 379, 379-87 (1887).

104. *See, e.g.,* William K. Jones, *Origins of the Certificate of Public Convenience and Necessity: Developments in the States, 1870-1920*, 79 COLUM. L. REV. 426, 426-27 (1979); MILTON L. MUELLER, JR., UNIVERSAL SERVICE: COMPETITION, INTERCONNECTION, AND MONOPOLY IN THE MAKING OF THE AMERICAN TELEPHONE SYSTEM 1-3 (1997); AMY FRIEDLANDER, NATURAL MONOPOLY AND UNIVERSAL SERVICE: TELEPHONES AND TELEGRAPHS IN THE U.S. COMMUNICATIONS INFRASTRUCTURE, 1837-1940, at 74-75 (1995); Civil Aeronautics Act of 1938, ch. 601, § 303, 52 Stat. 973, 986 (“There shall be no exclusive right for the use of any landing area or air navigation facility upon which Federal funds have been expended.”).

105. *See* United States v. AT&T, 552 F. Supp. 131, 227 (D.D.C. 1982). AT&T’s competitors, known as Baby Bells, largely consisted of companies that were spun off of the Bell System in response to the consent decree. *See* Press Release, U.S. Dep’t of Just., Justice Department Seeks Complete Removal of AT&T Consent Decree: Takes Action Against Efforts to Block Proper Implementation of New Telecommunications Law 1 (Feb. 28, 1996), https://www.justice.gov/archive/atr/public/press_releases/1996/0552.pdf [<https://perma.cc/AK87-ACXM>].

nondiscriminatory access to pipeline customers.¹⁰⁶ In 1996, the Federal Energy Regulatory Commission ordered transmission utilities to provide generators with open access to the distribution system that transports electric power from producers to consumers.¹⁰⁷ In 2015, the FCC promulgated its Open Internet Order, essentially an open-access requirement for ISPs.¹⁰⁸ And now, with the increasing influence of Facebook, Google, Apple, and Amazon, policymakers are considering whether open access and interoperability are appropriate tools for regulating large tech firms.¹⁰⁹

The idea behind each of these regulatory frameworks is that coordination requirements enable an industry to capture the benefits generated by economies of scale and network effects while also mitigating the problems created by monopoly power. Yet, as the next Part shows, this idea belies the complex challenges associated with the design and implementation of open-access and interoperability requirements and the resulting risk that they may become the very instruments by which dominant firms obtain and entrench monopoly power.

II. THE HISTORY OF NSCC AND DTC

Our image of American securities markets is dominated by Wall Street. When we think of securities markets, we imagine crowded trading floors, electronic trading screens, brash cable-news hosts, and titans of industry ringing the opening bell at the New York Stock Exchange (NYSE). But the institutions that *really* move money on Wall Street reside around the corner—quite literally—at

106. See Regulation of Natural Gas Pipelines After Partial Wellhead Decontrol, 50 Fed. Reg. 42408, 42493 (Oct. 9, 1985) (codified at 18 C.F.R. pt. 284); see also N. Nat. Gas Co., 48 FERC 61232, 61828-29 (1989), 1989 WL 418487, at *5 (describing “the Commission’s encouragement of open access to interstate pipelines’ systems” and stating that “[t]he goal of [current] policy is to provide incentives and opportunities that allow all shippers, industrial users as well as [local distribution companies] and other parties, to benefit by access to commodity and transportation markets at price levels indicating market discipline”).

107. See Promoting Wholesale Competition Through Open Access Non-Discriminatory Transmission Services by Public Utilities, 61 Fed. Reg. 21540, 21541 (Apr. 24, 1996) (codified at 18 C.F.R. pts. 35, 385) (requiring transmission-line owners to file “open access non-discriminatory transmission tariffs”).

108. See Protecting and Promoting the Open Internet, 30 FCC Rcd. 5601, 5603 ¶ 4 (2015). As noted earlier, however, the FCC has repealed the Open Internet Order. See Restoring Internet Freedom, 33 FCC Rcd. 311, 312-13 (2017).

109. The House Judiciary Committee, in its 2020 report on competition in digital markets, explicitly embraced open-access and interoperability requirements as a regulatory strategy for mitigating the growing market power of the largest tech firms. See MAJORITY STAFF OF THE SUB-COMM. ON ANTITRUST, COM. & ADMIN. L. OF THE H. COMM. ON THE JUDICIARY, 116TH CONG., INVESTIGATION OF COMPETITION IN DIGITAL MARKETS: MAJORITY STAFF REPORT AND RECOMMENDATIONS 17-20 (2020).

55 Water Street. This is the home of DTCC and its twin subsidiaries, NSCC and DTC.¹¹⁰ Today, NSCC is America’s only securities clearinghouse, and DTC its only securities depository. This Part first explains the important functions that clearinghouses and depositories perform. It then traces the untold history of securities clearinghouses and depositories in the United States to show how the SEC’s open-access and interoperability requirements were one of the instruments by which NSCC and DTC obtained their current monopolies.

A. Overview of Clearinghouses and Depositories

Securities clearinghouses and depositories are part of the vast and complex plumbing of the financial system.¹¹¹ When a security is traded on the NYSE, Nasdaq, or another trading platform, the transaction details—including the identities of the parties and the type, quantity, and price of the security—are sent to a clearinghouse.¹¹² The clearinghouse then compares the information submitted by each party (a process known as *clearing*), identifies and reconciles any errors (*reconciliation*), and coordinates the transfer of securities to the buyer and funds to the seller (*settlement*).¹¹³ As part of this process, clearinghouses may also identify and net out—that is, cancel—any offsetting obligations owed between the two parties. A specialized subset of clearinghouses known as central counterparties (CCPs) also stands between the buyer and seller, guaranteeing the performance of each party’s obligations.¹¹⁴ If one party cannot honor its com-

110. For operational reasons, many of DTCC’s core functions are now performed in its offices across the Hudson River in Jersey City, New Jersey. See *DTCC Moves Most Operations to NJ*, TRADERS MAG. (Dec. 14, 2012), <https://www.tradersmagazine.com/departments/clearing/dtcc-moves-most-operations-to-nj> [<https://perma.cc/2XFW-JH89>].

111. For excellent analyses of other aspects of financial plumbing, see Ricks, *supra* note 6; Morgan Ricks, *Safety First? The Deceptive Allure of Full Reserve Banking*, 83 U. CHI. L. REV. ONLINE 113 (2016); John Crawford, Lev Menand & Morgan Ricks, *FedAccounts: Digital Dollars*, 89 GEO. WASH. L. REV. 113 (2021); and Peter Conti-Brown & David A. Wishnick, *Private Markets, Public Options, and the Payment System*, 37 YALE J. ON REGUL. 380 (2020).

112. For purposes of the Securities Exchange Act, these clearinghouses fall into the category of “clearing agencies.” See 15 U.S.C. § 78c(a)(23)(A) (2018) (providing the statutory definition of “clearing agency”).

113. See *Glossary of Terms Related to Payment, Clearing and Settlement Systems*, EUR. CENT. BANK 5, 22, 24 (Dec. 2009), <https://www.ecb.europa.eu/pub/pdf/other/glossaryrelatedtopaymentclearingandsettlementsystems.pdf> [<https://perma.cc/8MQQ-DUMJ>].

114. See Comm. on Payment & Settlement Sys., *supra* note 28, at 3 (defining “central counterparty” as “[a]n entity that interposes itself between counterparties to contracts traded in one or more financial markets, becoming the buyer to every seller and the seller to every buyer and thereby ensuring the performance of open contracts”).

mitments, a CCP will step into the shoes of that party and perform its contractual obligations.¹¹⁵ CCPs thus protect financial-market participants against the risk of counterparty default. At present, NSCC is the only CCP for publicly traded equity securities in the United States, clearing an average of over one *trillion* dollars' worth of equity securities per day.¹¹⁶

Depositories, meanwhile, perform a variety of complementary functions. Most importantly, depositories keep records of the legal and beneficial owners of securities. They also update these records to reflect changes in ownership following the settlement of a trade. Until the 1970s, this function involved the safekeeping and physical transfer of paper stock certificates.¹¹⁷ Today, depositories mostly memorialize the ownership and transfer of securities electronically, moving money and intermediated securities between customer accounts held with the depository.¹¹⁸ Many depositories also oversee corporate actions that are incidental to securities ownership. This includes the payment of dividends on shares, along with interest payments on bonds and other fixed-income investments.¹¹⁹ Today, DTC is the sole depository for all equity, corporate, and municipal debt instruments traded in the United States.¹²⁰ As of November 2020, DTC provided custodial service for securities worth an estimated \$37.2 trillion and processed “[a]pproximately 1.4 million settlement-related transactions per day, with a value of approximately \$600 billion.”¹²¹

115. *See id.*

116. *See 2019 Annual Report*, DTCC 36 (2019), https://www.dtcc.com/annuals/2019/pdf/2019_DTCC_Annual%20Report_Print.pdf [<https://perma.cc/DP4H-42GB>]; *Advancing Together: Leading the Industry to Accelerated Settlement*, DTCC (Feb. 24, 2021), <https://www.dtcc.com/dtcc-connection/articles/2021/february/24/advancing-together-leading-the-industry-to-accelerated-settlement> [<https://perma.cc/25Z9-59FW>] (“[O]n a typical trading day, NSCC processes an average of about \$1.7 trillion in equities transactions.”).

117. *See infra* Section II.B.

118. *See 2021 Annual Report*, DTCC 21 (2021), https://www.dtcc.com/~/_media/files/downloads/about/annual-reports/DTCC-2021-Annual-Report [<https://perma.cc/D555-2DZT>]. Intermediated securities are interests in investment securities held by participants “through a chain of financial institutions, such as banks, investment platforms and brokers.” *Intermediated Securities: Who Owns Your Shares? A Scoping Paper*, LAW COMM’N 1 (Nov. 11, 2020), <https://s3-eu-west-2.amazonaws.com/lawcom-prod-storage-11jsxou24uy7q/uploads/2020/11/Law-Commission-Intermediated-Securities-Scoping-Paper-1.pdf> [<https://perma.cc/VT7H-GL3L>].

119. *See 2019 Annual Report*, *supra* note 116, at 72.

120. *See FAQs: How Issuers Work with DTC*, DTCC, <https://www.dtcc.com/settlement-and-asset-services/issuer-services/how-issuers-work-with-dtc> [<https://perma.cc/YLR3-4UEV>] (“DTC provides . . . settlement services for virtually all equity, corporate and municipal debt trades . . . in the U.S.”).

121. *Id.*

The first American clearinghouse was established in New York in 1853.¹²² In little over a decade, clearinghouses had also sprung up in other major commercial centers, including Boston in 1856, Philadelphia in 1858, Baltimore in 1858, and Chicago in 1865.¹²³ By the 1880s, “clearinghouses dotted the American banking landscape,”¹²⁴ and by the turn of the century, more than 100 clearinghouses operated in the United States and Canada.¹²⁵ These early clearinghouses were mostly owned by banks, which used them to clear and settle checks and other negotiable instruments issued by other banks.¹²⁶

Prior to the advent of these clearinghouses, banks typically cleared and settled checks using informal networks of correspondent relationships.¹²⁷ These correspondent relationships required each bank to maintain a separate set of books to record the checks and other negotiable instruments drawn and cashed with each of the other banks in the network. Representatives (typically junior clerks or couriers) of two banks would meet periodically to calculate and settle their accounts. The net debtor would then pay the net creditor in paper currency or coins. This bilateral settlement process was remarkably inefficient. If Bank A owed \$100 to Bank B, and Bank B owed \$100 to Bank C, and Bank C owed \$100 to Bank A, each bank would send someone to the other bank to pay the money they owed even though the positions canceled each other out.

Clearinghouses replaced this system with a multilateral clearing and settlement process. Rather than periodically calculating and settling net debts on a bilateral basis, multilateral netting contemplates that *each* member bank would settle its net debts with *all other* member banks within a single institution: the clearinghouse itself. To facilitate multilateral netting, the clearinghouse would first aggregate, calculate, and confirm the payments owed by or to each of its member banks. It would then pay (or collect) the net amount owed to (or by) each member. Clearinghouses thus centralized the payment process. This reduced the total number and size of payments, along with the exposure of both

122. See William A. Camp, *The New York Clearing House*, 154 N. AM. REV. 684, 685 (1892). The first clearinghouse was likely established in London in 1773. See *id.* at 684.

123. See Gary Gorton, *Private Clearinghouses and the Origins of Central Banking*, BUS. REV., Jan.-Feb. 1984, at 3, 5.

124. *Id.*

125. See THE RAND-MCNALLY BANKERS' DIRECTORY AND LIST OF ATTORNEYS 17 (1900), <https://fraser.stlouisfed.org/files/docs/publications/rmbd/1900BankDir2.pdf> [<https://perma.cc/U3AT-QMUE>].

126. See Gorton, *supra* note 123, at 3-4; Charles W. Calomiris & Gary Gorton, *The Origins of Banking Panics: Models, Facts, and Bank Regulation*, in FINANCIAL MARKETS AND FINANCIAL CRISES 109, 119 (R. Glenn Hubbard ed., 1991).

127. See Gorton, *supra* note 123, at 4.

the clearinghouse and each member bank to the default of other banks in the network.¹²⁸

A second advantage of clearinghouses was that, by reducing the number and size of interbank payments, they greatly reduced the need for banks to keep large amounts of cash on hand to settle their bilateral payment obligations.¹²⁹ In theory, each bank needed only to keep enough cash on hand to settle its net obligations to the clearinghouse. In practice, clearinghouses would also often issue certificates that served as cash substitutes for the expressly limited purpose of settling transactions between a clearinghouse and its member banks.¹³⁰ These certificates eliminated the transportation, security, and other costs of settling payments in cash.

Lastly, in the absence of a central bank, clearinghouses quickly evolved to support the safety and soundness of the financial system.¹³¹ Between 1800 and 1915, twelve bank panics roiled the American financial system and broader economy.¹³² Depositors, concerned about possible bank failures, rushed to withdraw their deposits.¹³³ Because banks do not hold all their deposits in cash or other liquid reserves, they were often unable to meet the demands of their depositors.¹³⁴

Clearinghouses provided a solution to this liquidity problem.¹³⁵ Facing an incipient panic, banks would submit bonds and other investments to the clearinghouse as collateral.¹³⁶ In exchange, the clearinghouse would issue certificates that banks could then use to satisfy their outstanding obligations within the

128. See Michael Fleming & Frank Keane, *The Netting Efficiencies of Marketwide Central Clearing* 4-7 (Fed. Rsv. Bank of N.Y., Staff Rep. No. 964, 2021), https://www.newyorkfed.org/media-library/media/research/staff_reports/sr964.pdf [<https://perma.cc/XK6B-ANXF>] (describing the benefits of clearing and netting); Craig Pirrong, *The Economics of Central Clearing: Theory and Practice* 2-3 (Int'l. Swaps & Derivatives Ass'n, Discussion Papers Series No. 1, 2011), <https://www.isda.org/a/yiEDE/isdadiscussion-ccp-pirrong.pdf> [<https://perma.cc/H8HE-E3FN>] (explaining how central counterparties (CCPs) “transform systemic risk” and “are a risk pooling and sharing mechanism”).

129. See Fleming & Keane, *supra* note 128, at 4-5.

130. These certificates were themselves typically backed by gold deposited by one member bank with another designated member bank. See *id.*

131. See Richard H. Timberlake, Jr., *The Central Banking Role of Clearinghouse Associations*, 16 J. MONEY, CREDIT & BANKING 1, 2 (1984); Gorton, *supra* note 123, at 8-11.

132. See Gorton, *supra* note 123, at 5.

133. See *id.*

134. See *id.*

135. See *id.*

136. See *id.* at 5-7; see also Timberlake, *supra* note 131, at 3-4 (describing the development of clearinghouse loan certificates).

clearing network, thereby freeing up much-needed cash to honor their commitments to depositors and other creditors. In some cases, the certificates even found their way into public circulation.¹³⁷ Member banks were willing to accept these certificates not only because they were backed by collateral but also because they represented the *joint* obligations of other member banks.¹³⁸ When a member bank defaulted and the posted collateral was insufficient to cover its outstanding obligations, surviving members would thus be required to cover the residual losses in proportion to their capital in the clearinghouse.¹³⁹

The innovation of the clearinghouse would eventually spread from banking to securities markets. The NYSE took its initial, limited foray into securities clearing in 1892.¹⁴⁰ This was followed by the creation of the Stock Clearing Corporation in 1920.¹⁴¹ But it was not until the dramatic spike in securities-trading volumes in the late 1960s that the central importance of this new financial-market infrastructure became abundantly clear.

B. The Paperwork Crisis and the Birth of NSCC and DTC

Over a hundred years after the New York Clearing House cleared its first check, American securities markets remained vulnerable to many of the problems that had plagued banks in the nineteenth century. Throughout the 1960s and well into the 1970s, stock certificates still had to change hands physically for every trade.¹⁴² Compounding matters, the brokerage firms that processed these trades relied on about thirty-three different documents to execute each and every trade.¹⁴³ This cumbersome process barely held during the early 1960s, when equity-trading volumes rarely exceeded three million shares per day.¹⁴⁴ By the end

137. Initially, these loan certificates were only issued in large denominations and circulated exclusively among member banks. By the 1890s, however, clearinghouses had begun issuing small-denomination certificates, many of which found their way into public circulation. During the Panic of 1893, for example, clearinghouses issued approximately \$100 million in small-denomination certificates. During the Panic of 1907, this figure jumped to approximately \$500 million. See Gorton, *supra* note 123, at 7-8.

138. *See id.*

139. *See id.* While defaulting banks were typically not permitted to fail during a panic, they were often expelled from the clearinghouse once the panic subsided. *See id.* at 9. The threat of expulsion was thus viewed as a powerful enforcement mechanism.

140. *See* Bernanke, *supra* note 27, at 3-4.

141. *See* N.Y. STOCK EXCH., REPORT OF THE PRESIDENT: MAY 1ST, 1929-MAY 1ST, 1930, at 66-68 (1930).

142. *See* Bergmann, *supra* note 42.

143. *See id.*

144. *See id.*

of the decade, however, average daily equity-trading volumes had reached thirteen million shares a day,¹⁴⁵ with the NYSE experiencing several days on which twenty to thirty million shares changed hands.¹⁴⁶ Like banks a hundred years earlier, brokerage firms had to employ hundreds of messengers to run around Lower Manhattan to settle transactions physically.¹⁴⁷ The dramatic spike in trading volumes pushed the analog clearing-and-settlement system to the brink of collapse. Wall Street was drowning in a sea of paper.

The market disruptions that ensued came to be known as the “Paperwork Crisis.”¹⁴⁸ Throughout the late 1960s and early 1970s, stock exchanges had to close early and halt trading on Wednesdays to catch up with backlogged paper trade orders.¹⁴⁹ Firms regularly lost track of physical securities in their possession.¹⁵⁰ The resulting settlement failures led to at least \$4 billion in losses during the late 1960s alone.¹⁵¹ As firms struggled to keep up with the increasing volume of trades, market participants worried that financial institutions would be unable to monitor their holdings and manage their security positions.¹⁵²

In a report on the Paperwork Crisis, the SEC explained that an “archaic method of achieving this simple objective [of transferring securities] nearly drowned the financial community in a tidal wave of uncontrolled paper.”¹⁵³ Not to mince words, the SEC asserted that

[t]here is no area of the securities business which offers more opportunity for reducing costs as well as exposure to the kind of disruption which resulted in loss to customers during the 1969-70 period, than the improvement and modernization of the systems for clearing, settlement, delivery and transfer of securities.¹⁵⁴

NSSC and DTC emerged in the immediate aftermath of the Paperwork Crisis. DTC was established in 1973 as “a cooperative effort to build a broad depository system which reduces trade completion costs and alleviates the problems

145. *See id.*

146. *See* U.S. SEC. & EXCH. COMM’N, STUDY OF UNSAFE AND UNSOUND PRACTICES OF BROKERS AND DEALERS, H.R. DOC. NO. 92-231, at 13 (1971).

147. *See id.* at 19, 277-80.

148. *Id.* at 13.

149. *See id.* at 28, 211.

150. *See id.* at 20, 28.

151. *See id.* at 19.

152. *See id.* at 27-28.

153. *Id.* at 36.

154. *Id.* at 35-36.

of loss, theft and error arising from out-dated procedures.”¹⁵⁵ While DTC was initially a wholly owned subsidiary of the NYSE, its operations were governed by a memorandum of understanding between the NYSE, American Stock Exchange (Amex), National Association of Securities Dealers (NASD), and the member banks of the New York Clearing House Association.¹⁵⁶ The NYSE, Amex, and NASD would go on to jointly establish NSCC in 1976.¹⁵⁷ Because the NYSE and Amex were responsible for the lion’s share of U.S. equity-trading volumes,¹⁵⁸ this instantly made NSCC and DTC important players in the emerging market for securities clearing and depository services.

To resolve the Paperwork Crisis, Congress amended the Securities Exchange Act in 1975 to authorize the SEC under the newly created Section 17A to “facilitate the establishment of a national system for the prompt and accurate clearance and settlement of transactions in securities.”¹⁵⁹ To that end, Congress directed the SEC “to end the physical movement of securities certificates in connection with the settlement among brokers and dealers of transactions in securities.”¹⁶⁰ Hence the development of centralized securities depositories.¹⁶¹ Congress also required all securities clearinghouses to register with the SEC, meet heightened capital requirements, and develop infrastructure that would allow them to process securities transactions more efficiently.¹⁶²

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155. *Annual Report 1973*, THE DEPOSITORY TR. CO. 1 (1974), http://3197d6d14b5f19f2f440-5e13d29c4c016cf96cbbfd197c579b45.r81.cf1.rackcdn.com/collection/papers/1970/1973_0101_DTCAR.pdf [<https://perma.cc/4VFD-84XE>].
156. For example, this memorandum of understanding contemplated that the majority of DTC’s directors would be nominated by firms other than the NYSE. *See id.* at 3.
157. *See 42nd Annual Report of the SEC for the Fiscal Year Ended June 30, 1976*, U.S. SEC. & EXCH. COMM’N 19 (1976) [hereinafter *SEC 1976 Annual Report*], https://www.sec.gov/about/annual_report/1976.pdf [<https://perma.cc/JEN9-SPVK>]; *National Securities Clearing Corporation (NSCC)*, DTCC, <https://www.dtcc.com/about/businesses-and-subidiaries/nscc> [<https://perma.cc/X5VL-6ESJ>].
158. *See SEC 1976 Annual Report*, *supra* note 157, at 108, 192.
159. Securities Acts Amendments of 1975, sec. 15, § 17A(a)(2), 89 Stat. 97, 141 (codified at 15 U.S.C. § 78q-1(a)(2)(A)(i)).
160. *Id.* sec. 15, § 17A(e), 89 Stat. at 146 (codified at 15 U.S.C. § 78q-1(e)).
161. *See* Depository Trust Co., et al.; Order, Exchange Act Release No. 20221, 48 Fed. Reg. 45167, 45168 (Sept. 23, 1983). Before the Act, the NYSE had established the Central Certificate Service to act as its depository. *See 1970’s*, DTCC, <https://www.dtcc.com/annuals/museum/index.html> [<https://perma.cc/99TB-39XP>].
162. *See* Securities Acts Amendments, sec. 15, § 17A(b)(1), 89 Stat. at 141-42 (codified at 15 U.S.C. § 78q-1(b)(1)) (requiring clearinghouses to register with the SEC); *id.* sec. 15, § 17A(b)(3)(A), 89 Stat. at 142 (codified at § 78q-1(b)(3)(A)) (requiring clearing agencies to have “the capacity to be able to facilitate the prompt and accurate clearance and settlement of securities transactions”).

By most measures, the SEC has successfully realized Congress's ambition to develop a centralized national system for securities clearing and settlement. Today, DTCC owns both DTC and NSCC.¹⁶³ DTC acts as the depository for trillions of dollars of financial products, including publicly traded equities, municipal and corporate bonds, and derivatives.¹⁶⁴ Rather than physically exchange securities certificates, DTC maintains electronic records of securities ownership and simply updates these records whenever a trade is settled.¹⁶⁵ This process, known as automated book entry, has dramatically reduced incidents where the seller fails to deliver the securities it has sold to the buyer, known as "fails to deliver" (FTDs).¹⁶⁶ During the Paperwork Crisis, these FTDs cost brokerage firms billions of dollars and led to the closure of over 150 institutions.¹⁶⁷

NSCC has also contributed to a safer and more resilient financial system. When equities, municipal or corporate debt, or other securities are exchanged, NSCC reduces each party's exposure via multilateral netting. If Broker A owes Broker B \$100, Broker B owes Broker C \$100, and Broker C owes Broker A \$50, the most efficient way to discharge these obligations is simply for Broker A to pay Broker C \$50. There is no reason for Broker A to pay Broker B \$100, or for Broker C to pay Broker A, since the three debts can be "netted" out, leaving only a single payment of \$50 from Broker A to Broker C. The same goes for the delivery of securities. Rather than a complex daisy chain of ownership transfers, NSCC and DTC enable securities to be delivered on a net basis at the end of each trading day.

The advantages of multilateral netting are especially apparent when a broker becomes insolvent. If, in our example, Broker B fails, its counterparties would

163. See *Depository Trust and Clearing Corporation (DTCC)*, CORP. FIN. INST., <https://corporate-financeinstitute.com/resources/knowledge/trading-investing/depository-trust-and-clearing-corporation-dtcc> [<https://perma.cc/SJF2-L9NB>].

164. See *id.*

165. See, e.g., Letter from ETFS Palladium Tr. to The Depository Tr. Co. (Mar. 25, 2008), https://www.sec.gov/Archives/edgar/data/1459862/000093041309002193/c57140_ex10-3.htm [<https://perma.cc/Z872-7V8B>].

166. *NSFR Treatment of Trade Date Receivable Fails*, THE CLEARING HOUSE 4 (Aug. 21, 2017), <https://www.federalreserve.gov/regreform/tr-commpublic/tch-meeting-20171012.pdf> [<https://perma.cc/3GW5-XFBB>].

167. See Robert J. Cole, *Record Stock Volume a Factor in Brokerage Crisis*, N.Y. TIMES (Mar. 14, 1970), <https://www.nytimes.com/1970/03/14/archives/record-stock-volume-a-factor-in-brokerage-crisis.html> [<https://perma.cc/KF6B-ZG9L>] ("The New York Stock Exchange first began compiling data on the failure of brokers to deliver securities among themselves and to customers in April, 1968, when the level of fails stood at \$2.67 billion. By December, 1968, the level had soared to a record of \$4.13 billion."); Bergmann, *supra* note 42 ("Operational deficiencies caused fail rates and customer complaints to soar. Losses in 1967-1968 caused an unprecedented number of broker-dealer firm failures. For example, roughly 160 New York Stock Exchange . . . member firms went out of business while others either merged or liquidated.").

not be adversely affected if its obligations had been netted out because those obligations would be extinguished. However, without a system to net out these positions, Broker *B*'s insolvency would mean that Broker *C* would not receive the \$50 it is owed. That, in turn, could prevent Broker *C* from paying Broker *A*. In this way, multilateral netting greatly reduces the likelihood that one broker's failure will trigger a cascading series of additional failures. Through multilateral netting, NSCC and DTC have thus eliminated trillions of dollars in bilateral counterparty credit risk.¹⁶⁸

In addition to multilateral netting, NSCC employs two mechanisms to mitigate the risk that a broker will default on its payment or delivery obligations. The first is collateral – or “margin” – requirements. Each NSCC member is required to post margin to guarantee its obligations to deliver cash and securities to NSCC. The amount of margin that each member must post is calculated on the basis of, among other factors, the size, volatility, and concentration of its net unsettled positions.¹⁶⁹ Multilateral-netting and margin requirements thus work hand in hand: whereas the former reduces the *size* of each market participant's obligations to NSCC, the latter *collateralizes* any residual net exposures.

The second mechanism stems from NSCC's role as a CCP. NSCC guarantees that funds will be delivered to the seller and that purchased securities will be delivered to the buyer. If a counterparty defaults, NSCC will first use the collateral that the defaulting party posted as margin against its outstanding obligations. If those funds prove insufficient, NSCC can tap into a dedicated default fund financed by mandatory contributions from market participants as a condition of their membership.¹⁷⁰ NSCC employs similar mechanisms to guarantee the delivery of purchased securities.¹⁷¹

The stated purpose of the 1975 amendments to the Securities Exchange Act was, in part, “to remove impediments to and perfect the mechanisms of . . . a national system for the clearance and settlement of securities transactions.”¹⁷² Viewed against the backdrop of the valuable roles that NSCC and DTC now play,

168. See Bergmann, *supra* note 42 (“Today, NSCC functions as the world's largest central counterparty The value of the transactions processed in 2002 was \$81 trillion”). For a more in-depth discussion of netting, see Craig Pirrong, *The Industrial Organization of Execution, Clearing and Settlement in Financial Markets* (Ctr. for Fin. Stud., CFS Working Paper No. 2008/43, 2007), <https://www.econstor.eu/bitstream/10419/43251/1/599235586.pdf> [<https://perma.cc/3FNK-FSBP>].

169. See *Rules & Procedures*, NSCC 344-61 (Sept. 1, 2022), https://www.dtcc.com/~media/Files/Downloads/legal/rules/nsc_rules.pdf [<https://perma.cc/2L66-F3TZ>] (delineating the calculations to determine each member's margin obligations).

170. See *id.* at 81-84 (delineating the procedures for responding to a member default).

171. See *id.*

172. Securities Acts Amendments of 1975, sec. 2, § 2, 89 Stat. 97, 97 (codified at 15 U.S.C. § 78b).

that project appears to have been largely successful. Today, NSCC clears, reconciles, and settles the vast majority of securities transactions within two business days.¹⁷³ The ownership of these securities is then automatically updated via DTC's book-entry system. The result is a more efficient and resilient financial system.¹⁷⁴

C. Consolidation, Not Coordination

Yet, the SEC failed to achieve its congressional mandate in at least one important respect. While today securities clearinghouses and depositories are widely viewed as natural monopolies,¹⁷⁵ when Congress amended the Securities Exchange Act in 1975, the competitive landscape included not only NSCC and DTC, but also a collection of regional clearinghouses and depositories. These

173. See Virginia B. Morris, *Guide to Clearance and Settlement: An Introduction to DTCC*, DTCC 13 (2021), <https://www.dtcc.com/-/media/Files/Downloads/DTCC-Connection/DTCC-Interactive-Guide-to-Clearance-and-Settlement-2022.pdf> [<https://perma.cc/8D3X-3VSV>].

174. See TINA P. HASENPUSCH, *CLEARING SERVICES FOR GLOBAL MARKETS* 2 (2009); Donald L. Calvin, *The National Market System: A Successful Adventure in Industry Self-Improvement*, 70 VA. L. REV. 785, 800 (1984); Kress, *supra* note 26, at 51, 65-66.

175. See Manmohan Singh, *Collateral, Netting and Systemic Risk in the OTC Derivatives Market* 8 (Int'l Monetary Fund, Working Paper No. 10/99, 2010), <https://www.imf.org/external/pubs/ft/wp/2010/wp1099.pdf> [<https://perma.cc/BNS7-JLY2>] ("A key incentive in favor of moving OTC [over-the-counter] derivatives to CCPs is higher multilateral netting and the corresponding reduction in counterparty risk or additional benefits from portfolio margining where exposures across all OTC products would be offset. In this latter case, the intuition is that the margin required to cover the exposure of the portfolio would be smaller under a CCP than margining its individual components, since the prices of the portfolio's components would be correlated and could be offset in a CCP. However, if there are multiple CCPs that are not linked the benefits of netting are reduced because cross-product netting will not take place."); Darrell Duffie & Haoxiang Zhu, *Does a Central Clearing Counterparty Reduce Counterparty Risk?*, 1 REV. ASSET PRICING STUD. 74, 75 (2011) ("[C]ounterparty credit risk in the OTC derivatives market is exacerbated by a multiplicity of CCPs."). On the single-firm dominance of markets served by financial-market utilities due to economies of scale and high fixed costs, see RUBEN LEE, *RUNNING THE WORLD'S MARKETS: THE GOVERNANCE OF FINANCIAL INFRASTRUCTURE* 20-21 (2011); DERMOT TURING, *CLEARING AND SETTLEMENT IN EUROPE* § 6.41 (2012); Li Lin & Jay Surti, *Capital Requirements for Over-the-Counter Derivatives Central Counterparties* 5 (Int'l Monetary Fund, Working Paper No. 13/3, 2013), <https://www.imf.org/external/pubs/ft/wp/2013/wp1303.pdf> [<https://perma.cc/FRE2-HG5W>]; and Douglas D. Evanoff, Daniela Russo & Robert S. Steigerwald, *Policymakers, Researchers, and Practitioners Discuss the Role of Central Counterparties*, 30 J. ECON. PERSPS. 2, 6 (2006), which states that "fixed cost within CCPs made up the bulk of operational expenses and . . . the marginal cost of clearing and settlement operations was essentially zero over a wide range of output levels. Thus, there were obvious reasons for consolidation, since the industry has the textbook characteristics of a natural monopoly."

regional players were located in cities like New York, Boston, San Francisco, Chicago, and Philadelphia, where they provided dedicated clearing, settlement, and depository services to affiliated stock exchanges.

There is relatively little publicly available information about these regional clearinghouses and depositories. Other than the descriptions that follow, it is not known how they were governed, how much the regional exchanges invested in them, or how much money they made or, more likely, lost. What is known is that the business of these regional players was initially focused on providing clearing, settlement, and depository services exclusively for the regional stock exchanges that owned them. Pursuant to the 1975 amendments, they were also required to register with the SEC as “clearing agencies” and comply with SEC rules regarding their governance, operations, and risk management.¹⁷⁶

Importantly, the existence of these regional players prompted Congress to list “*competition among . . . clearing agencies*” as one of the primary goals of the newly created Section 17A.¹⁷⁷ To that end, rather than grant a single clearinghouse or depository a monopoly, Congress directed the SEC to facilitate the “linking of all clearance and settlement facilities.”¹⁷⁸ Thus, Congress consciously and explicitly opted to impose coordination requirements on this burgeoning new industry.

The SEC seems to have taken this congressional mandate seriously. In an early rule, it acknowledged that, “rather than adopting approaches appropriate to a natural monopoly, *the Commission has sought to free the competitive potential present in the clearing and settlement area by imposing conditions on NSCC’s registration designed to sever existing restrictive ties between clearing agencies and their affiliated securities markets.*”¹⁷⁹ The SEC was also emphatic about the need

176. Securities Acts Amendments, sec. 15, § 17A(b), 89 Stat. at 141-44 (codified at 15 U.S.C. § 78q-1(b)). While these clearing agencies were all required to file periodic reports with the SEC, *see* 17 C.F.R. § 240.17a-1 (2021), our Freedom of Information Act request to obtain these reports was denied.

177. Securities Acts Amendments, sec. 15, § 17A(a)(2), 89 Stat. at 141 (codified as amended at 15 U.S.C. § 78q-1(a)(2)(A)) (emphasis added). The legislative history underscores Congress’s focus on maintaining and enhancing competition in securities markets. *See* S. REP. NO. 94-75, at 8 (1975) (“The bill approaches the problem of encouraging the development and implementation of a national market system from the point of view of preserving the competing markets for securities that have developed[] [and] breaking down all barriers to competition that do not serve a valid regulatory purpose . . .”).

178. Securities Acts Amendments, sec. 15, § 17A(1)(D), 89 Stat. at 141 (codified at 15 U.S.C. § 78q-1(a)(1)(D)); *see also* Market Reform Act of 1990, Pub. L. No. 101-432, sec. 5, 104 Stat. 963, 973 (codified at 15 U.S.C. § 78q-1(a)(2)(A)(ii)) (amending the Exchange Act to direct the SEC “to facilitate the establishment of linked or coordinated facilities for clearance and settlement of transactions in securities”).

179. National Securities Clearing Corp.: Order Granting Registration and Statement of Reasons, Exchange Act Release No. 13163, 42 Fed. Reg. 3916, 3937 (Jan. 13, 1977) (emphasis added).

to protect regional clearinghouses and depositories. As it encouraged the development of a “National Market System,” the SEC repeatedly pointed to Congress’s desire to facilitate competition among the clearing agencies.¹⁸⁰ On multiple occasions, the SEC even stated that “clearance and settlement is not a natural monopoly.”¹⁸¹

The SEC’s emphasis on promoting competition was also reflected in the concerns among market participants and other regulators that NSCC and DTC would abuse their growing market power.¹⁸² In the late 1970s, the SEC received comments from the regional clearinghouses and DOJ’s Antitrust Division challenging the SEC’s approach to the National Market System on the ground that it was anticompetitive and would open the door for NSCC and DTC to obtain monopolies.¹⁸³ In 1977, in its order approving NSCC’s registration, the SEC,

180. See, e.g., *id.* at 3916, 3919-20, 3926; see also Application of the National Securities Clearing Corporation for Registration as a Clearing Agency, Exchange Act Release No. 17562, 22 SEC Docket 129, 1981 WL 37791, at *20-23 (Feb. 20, 1981) (describing the steps taken by the SEC to try to ensure that NSCC’s registration did not undermine competition).

181. See, e.g., Application of the National Securities Clearing Corporation for Registration as a Clearing Agency, 1981 WL 37791, at *6; see also National Securities Clearing Corp.: Order Granting Registration and Statement of Reasons, 42 Fed. Reg. at 3937 (noting “the absence of evidence that would warrant predicating regulatory action on the assumption that clearing and settlement is a natural monopoly”).

182. In fact, the SEC has consistently acknowledged that industry concentration is a problem but found that other considerations outweigh those concerns. Compare Application of the National Securities Clearing Corporation for Registration as a Clearing Agency, 1981 WL 37791, at *6 (“[I]mplicit in the discussion of clearing agency competition is the Commission’s conclusion that clearance and settlement is not a natural monopoly.”), and *Bradford Nat’l Clearing Corp. v. SEC*, 590 F.2d 1085, 1099 (D.C. Cir. 1978) (approving the SEC’s decision to require NSCC to “meet[] four conditions designed to ameliorate the anticompetitive effects that NSCC’s opponents feared”), with Order Relating to the Chicago Stock Exchange’s Withdrawal from Clearance, Settlement, Depository, and Branch Receive Business, Exchange Release No. 36684, 61 Fed. Reg. 1195, 1198 (Jan. 5, 1995) (approving proposed rule changes related to the Chicago Stock Exchange’s withdrawal from the clearing and depository markets while noting that “consolidation of core services poses a risk that support for innovative products, trading systems, and clearing procedures could flounder”).

183. See National Securities Clearing Corp.: Order Granting Registration and Statement of Reasons, 42 Fed. Reg. at 3930 (“A number of NSCC’s potential clearing corporation competitors and the United States Department of Justice expressed the view that NSCC’s activities should be restricted to New York City, either indefinitely or for a fixed period, in order to protect clearing corporations operating outside New York City from the dangers of competition with NSCC.”); *Bradford Nat’l Clearing Corp.*, 590 F.2d at 1099 (“In general, NSCC registration was supported by brokers and dealers whether located in New York or elsewhere. Opposing registration were the regional exchanges and their affiliated clearing agencies, as well as petitioners and the Antitrust Division of the Justice Department . . .”). Congress may well have refused to include as stringent a general provision forbidding anticompetitive impacts as the Department of Justice (DOJ) desired because of Congress’s inclusion of specific restrictions

too, expressed concern “that competing clearing corporations would be unable to offer comparable services.”¹⁸⁴

In response to these concerns, the SEC instructed NSCC and DTC “to establish full interfaces with continuous netting systems.”¹⁸⁵ As a result, all clearinghouses and depositories were required to develop interoperable communication platforms that would allow market participants to implement both multilateral netting and automated book entry.¹⁸⁶ DTC and the regional depositories were similarly required to participate in a “Regional Interface Operation”

against the anticompetitive practices that it found most undesirable. For example, no clearing agency may be registered if its rules allocate fees inequitably among its participants or fix rates for service provided by those participants. *See* Securities Acts Amendments, sec. 15, § 17A, 89 Stat. at 142 (codified as amended at 15 U.S.C. § 78q-1(b)(3)(D)-(E)).

Notably, the drafters of the House’s predecessor bill to the 1975 amendments, while expressing their view that the securities industry should be guided by “competition, rather than regulation,” H.R. REP. NO. 94-123, at 47 (1975), did not even include in that bill a general restriction against registering clearing agencies whose rules are unnecessarily, inappropriately, or in any other manner anticompetitive, *see* H.R. 4111, 94th Cong. § 17A(d) (1975). Instead, they sought to rely entirely on specific restrictions (i.e., those eventually included in the 1975 amendments) against particular anticompetitive practices. DOJ also expressed concern about the development of a national market system for clearing securities before Congress legislated on the subject. *See Bradford Nat’l Clearing Corp.*, 590 F.2d at 1105.

In 1975, three years before the SEC promulgated its National Market System rule, the three clearinghouses in New York determined that they would be better able to meet these regulatory obligations if they merged. NSCC was the result of this merger between the American Stock Exchange Clearing Corporation (ASECC), the National Clearing Corporation (NCC), and the Stock Clearing Corporation (SCC). The merger took place in two phases. During Phase I, the regional clearinghouses remained tied to their associated exchanges and NSCC operated all three clearing agencies as separate divisions through the Securities Industry Automation Corporation. During Phase II, NSCC converted the separate clearing divisions into a single integrated entity, with the goal of providing all the services previously provided by ASECC, NCC, and SCC. *See* National Securities Clearing Corp.: Order Granting Registration and Statement of Reasons, 42 Fed. Reg. at 3924. At the outset, this merger left NSCC with approximately eighty-five percent market share. *See* SUBCOMM. ON OVERSIGHT & INVESTIGATIONS OF THE H. COMM. ON INTERSTATE & FOREIGN COM., 96TH CONG., NATIONAL MARKET SYSTEM: FIVE YEAR STATUS REPORT 48 (Comm. Print 1980) (quoting SUBCOMM. ON OVERSIGHT & INVESTIGATIONS AND SUBCOMM. ON CONSUMER PROT. & FIN. OF THE H. COMM. ON INTERSTATE & FOREIGN COM., 95TH CONG., OVERSIGHT OF THE FUNCTIONING AND ADMINISTRATION OF THE SECURITIES ACTS AMENDMENTS OF 1975, at 4-5 (Comm. Print 1977)).

¹⁸⁴ National Securities Clearing Corp.: Order Granting Registration and Statement of Reasons, 42 Fed. Reg. at 3931.

¹⁸⁵ *Id.* at 3929 (citation omitted). The SEC further emphasized that “[t]he availability of safe and efficient interfaces” supported “competition among clearing agencies.” Depository Interface Fees Incident, Exchange Act Release No. 20461, 48 Fed. Reg. 55654, 55656 (Dec. 7, 1983).

¹⁸⁶ *See* Depository Trust Co. et al., Exchange Act Release No. 34-27044, 44 SEC Docket 15, 1989 WL 550672, at *4 (July 18, 1989).

designed to ensure that all depositories could communicate with each other, process book-entry movements, and thereby “enable clearing corporations to settle, by book entry, trades between their respective participants.”¹⁸⁷ Collectively, the SEC’s requirements were designed to compel these regional players to work together to build a new interoperable, connected, and open-access infrastructure for supporting electronic clearing and settlement of securities trades.

To further address the concerns raised by the regional clearinghouses, DOJ, and the FTC, the SEC also took a series of steps that ultimately forced NSCC and DTC to bear the lion’s share of the costs of building this new infrastructure. As a preliminary matter, the SEC barred NSCC and DTC from charging interface fees.¹⁸⁸ NSCC therefore bore most of the costs of developing the new interoperability framework along with the associated network architecture. The SEC also closely scrutinized the fees clearinghouses charged market participants and prohibited NSCC from engaging in predatory pricing.¹⁸⁹ As a result, despite potentially being able to offer cheaper services due to its growing scale and sophistication, NSCC was prohibited from undercutting the rates offered by the regional clearinghouses. The SEC also required NSCC to permit regional clearinghouses to use the proprietary software NSCC had developed to enable brokerage firms to compare prices offered on different exchanges and other trading platforms.¹⁹⁰

187. Depository Interface Fees Incident, 48 Fed. Reg. at 55655 n.9; *see also* National Securities Clearing Corp.: Order Granting Registration and Statement of Reasons, 42 Fed. Reg. at 3929 (stating that the “Regional Interface Operation” will allow parties “to choose the marketplace for a transaction on the basis of the best price obtainable . . . and process the transaction through the clearing corporation of their choice”).

188. *See* Application of the National Securities Clearing Corporation for Registration as a Clearing Agency, Exchange Act Release No. 13163, 11 SEC Docket 1448, 1977 WL 173551, at *26 (Jan. 13, 1977) (“The first condition to which the Commission is subjecting NSCC’s registration responds to those concerns by requiring NSCC to offer to establish full interfaces with continuous netting systems and appropriate links with certain other clearing and settlement operations, without interface charges . . .” (footnote omitted)); *see also* National Securities Clearing Corp.: Order Granting Registration and Statement of Reasons, 42 Fed. Reg. at 3929-36 (summarizing these requirements).

189. *See* National Securities Clearing Corp.: Order Granting Registration and Statement of Reasons, 42 Fed. Reg. at 3933.

190. *See* National Securities Clearing Corp.: Order Approving Proposed Rule Change, Exchange Act Release No. 19705, 48 Fed. Reg. 20189, 20190 (Apr. 26, 1983) (“NSCC was required to provide, at cost, efficient facilities through which a broker or dealer located outside of New York City, either directly or through an agent, including a registered clearing corporation, could compare Amex, NYSE, and OTC transactions eligible for comparison at NSCC . . .”); *id.* (“NSCC was required to furnish to any requesting clearing corporation, without charge, computer programs for OTC trade comparison. In addition, the comparison of all OTC transactions between participants in two different clearing agencies was required to be performed

Despite being forced to shoulder most of the burden of developing this new market infrastructure, by the early 1980s, NSCC and DTC had successfully established interfaces with each of the regional clearinghouses and depositories.¹⁹¹ According to the SEC, these newly registered clearing agencies composed “the core components of an integrated national clearance . . . system that Congress” had envisioned when it adopted the 1975 amendments.¹⁹² Importantly, the SEC explained that this system was possible because “the interfaces that connect these organizations . . . permit clearing members to settle trades with or transfer customer accounts to members of other clearing agencies.”¹⁹³ At least in theory, Congress and the SEC had thus delivered on the promise to create an open and interoperable system for securities clearing, settlement, and custody—one that would enable NSCC, DTC, and regional clearinghouses and depositories to compete with each other on roughly equal terms.

Yet, just twenty years after Congress amended the Securities Exchange Act to create the National Market System and only fifteen years after the SEC first granted registration to NSCC, DTC, and other clearing agencies, all the regional players had halted their clearing and depository businesses and transferred their operations to NSCC and DTC.¹⁹⁴ Accordingly, while the SEC’s coordination requirements did eventually lead to the creation of a national market infrastructure, they did not do so by establishing a truly open and interoperable network for securities clearing and settlement. Instead, as described below, open-access and interoperability requirements ultimately contributed to the demise of the

by one clearing agency at no charge to the other clearing agency. If no other clearing agency was willing to operate the ‘national’ OTC comparison service, NSCC was required to compare all OTC transactions between participants in different clearing agencies without separate charge to participating clearing agencies . . .”).

191. See *Annual Report 1984*, THE DEPOSITORY TR. CO. 28 (1984), http://3197d6d14b5f192f440-5e13d29c4c016cf96cbbfd197c579b45.r81.cf1.rackcdn.com/collection/papers/1980/1984_0101_DTCAR.pdf [<https://perma.cc/4G6V-X256>] (“DTC also has interfaces for registered corporate and municipal securities services with Midwest Securities Trust Company (MSTC), Pacific Securities Depository Trust Company (PSDTC), and Philadelphia Depository Trust Company (Philadep). An important facility made possible by these relationships is the ‘third-party’ delivery service which permits a sole member of any one of these depositories to settle transactions with any member of DTC, eliminating the requirement that a member belong to both depositories in order to effect such settlements. Each of these interfaces was supplemented in 1982 and early 1983 by the linking of DTC’s Institutional Delivery system with the institutional delivery systems of the regional depositories. To assist settlements of trades on the Boston Stock Exchange, a DTC interface also exists with the Boston Stock Exchange Clearing Corp. and NSCC.”).

192. See *Depository Trust Co. et al.*, Exchange Act Release No. 34-27044, 44 SEC Docket 15, 1989 WL 550672, at *4 (July 18, 1989).

193. *Id.*

194. See *infra* Sections II.C.1-4.

regional clearinghouses and depositories. They did so by imposing high fixed costs to connect to the new market infrastructure, by allowing NSCC and DTC to dictate the direction and pace of innovation, and by preventing the regional players from differentiating their products and services from those of their larger competitors.

1. *Boston*

The Boston Stock Exchange (BSE) was the first to fall. Throughout the 1960s and 1970s, the BSE operated its own dedicated depository and clearinghouse. A BSE subsidiary, the New England Securities Depository Trust Company (NESDTC), provided depository services, while another subsidiary, the Boston Stock Exchange Clearing Corporation (BSECC), provided clearing and settlement services for trades executed on the BSE. The SEC granted temporary registration to BSECC in 1975 and to NESDTC in 1976,¹⁹⁵ the same status the SEC gave to NSCC, DTC, and each of the other regional clearinghouses and depositories.¹⁹⁶

Importantly, however, while these other clearinghouses and depositories all subsequently received full registration in 1983,¹⁹⁷ the SEC repeatedly extended Boston's temporary registration.¹⁹⁸ Even more importantly, when the SEC finally granted BSECC full registration in 1984, it did so not because the BSE's clearing and depository arms satisfied the conditions for full registration but because "DTC now performs virtually all the depository functions previously performed by the New England Depository Trust Company . . . and NSCC performs much of the securities transaction processing for BSECC."¹⁹⁹ Rather than investing in the technological, operational, and other infrastructure necessary to become a full participant in the SEC's new market infrastructure, the BSE thus elected to *outsource* its clearing and settlement functions to what, in theory at least, were its primary competitors.

195. See Registration as Clearing Agencies of Boston Stock Exchange Clearing Corp., and New England Securities Depository Trust Co., Exchange Act Release No. 20222, 48 Fed. Reg. 45167, 45167 (Sept. 23, 1983).

196. See Clearing Agencies: Filing of Applications for Registration, Exchange Act Release No. 11875, 40 Fed. Reg. 55910 (Nov. 26, 1975).

197. See Depository Trust Co. et al.; Order, Exchange Act Release No. 20221, 48 Fed. Reg. 45167, 45182 (Sept. 23, 1983). The eight-year delay between receiving temporary and full registration was caused by antitrust litigation brought against NSCC. See *Bradford Nat'l Clearing Corp. v. SEC*, 590 F.2d 1085 (D.C. Cir. 1978).

198. See Full Registration as a Clearing Agency; Boston Stock Exchange Clearing Corp.; Order, Exchange Act Release No. 21335, 49 Fed. Reg. 37879, 37879 (Sept. 20, 1984).

199. *Id.*

Compared to the other regional clearinghouses and depositories, there is relatively little evidence about why Boston so quickly shed its depository and clearing businesses. Still, its decision to leave the market is at least consistent with a desire to avoid the high costs of developing the infrastructure needed to coordinate with DTC, NSCC, and other regional players.²⁰⁰ To understand better the nature and source of these costs, it is important first to understand precisely what clearinghouses and depositories were being asked to do to implement the National Market System.

In the early 1980s, the SEC ordered securities clearinghouses and depositories to automate their systems, keep records of all the transactions they processed, and develop electronic systems for communicating with each other.²⁰¹ Importantly, if a broker that held its primary account with NSCC sold a security to a broker that held its primary account with one of the regional clearinghouses, NSCC and the regional clearinghouse had to be able to clear and settle the transaction just as if both brokers had an account with NSCC.²⁰² Similarly, if a broker that held an account with DTC sold securities to a broker that held its securities with a regional depository, DTC and the regional depository had to have a system for automatically updating the ownership records.²⁰³ That was the SEC's vision for a national market for securities clearing and settlement.

To meet these requirements, depositories had to keep comprehensive records of securities ownership and trade information, develop rules to safeguard the securities and funds under their control, and build electronic systems to communicate with each other so that depositories could update their records to settle transactions involving brokers that used different depositories. Clearinghouses, too, had to automate the clearing and settlement processes and build communications systems to compare, reconcile, and settle transactions that involved members of two or more clearinghouses. In an era before email or the internet, where a single IBM mainframe computer cost upwards of five million dollars (and still could not communicate with another computer on the other side of the

200. However, because the Boston Stock Exchange exited the clearing and depository markets so quickly, it is also possible that it did not want to comply with the other statutory requirements that did not involve linking with NSCC and DTC.

201. See Application of the National Securities Clearing Corporation for Registration as a Clearing Agency, Exchange Act Release No. 17562, 22 SEC Docket 129, 1981 WL 37791, at *21 (Feb. 20, 1981).

202. See *id.* at *7.

203. See *id.* at *22.

same room), compliance with these requirements demanded enormous investments in human, operational, and technological infrastructure.²⁰⁴

Making these investments was a risky proposition, especially for smaller regional stock exchanges. On the one hand, by the early 1980s, the steady growth in the volume of securities trading made investments in new technology and automation not just a regulatory requirement but also a virtual necessity for exchanges hoping to protect their market position. Yet as a December 1984 article in *American Banker* pointed out, doing so often required firms to develop entirely new computer systems, leading to “unavoidable complications” and placing “great strain on internal resources.”²⁰⁵ Compounding matters, “development costs for an internal securities processing system can amount to millions of dollars.”²⁰⁶ It could also take several years to develop, introducing the risk that the new system “could be technologically obsolete by the time it is completed.”²⁰⁷

In the end, developing this infrastructure proved too risky for the BSE. By 1983, every other regional clearinghouse and depository had developed or was in the process of developing a system for automatically transmitting trade information to NSCC and DTC.²⁰⁸ Not so for BSECC and NESDTC.²⁰⁹ Even when BSECC and NESDTC received final registration in 1984, the SEC’s approval was based on the fact that Boston had by this point effectively exited the clearing and depository businesses.²¹⁰ Rather than investing in the technology necessary to connect to the new SEC-mandated market infrastructure, the BSE chose to become a customer of NSCC and DTC.²¹¹

204. See W. Michael Cox & Richard Alm, *Time Well Spent: The Declining Real Cost of Living in America*, in 1997 ANNUAL REPORT, FED. RSRV. BANK OF DALL. 2, 18 (1997), https://www.minneapolisfed.org/~media/files/research/prescott/quant_macro/arpt97.pdf [<https://perma.cc/YAN4-UZ9Y>].

205. Stephen Gardos, *State-of-the-Art Automation Provides Means to Boost Profits; Upgrading Securities Data Processing Improves Service to the Bank’s Demanding Customers and Reduces Overhead*, AM. BANKER, Dec. 5, 1984, LEXIS.

206. *Id.*

207. *Id.*

208. See Depository Trust Co., et al.; Order, Exchange Act Release No. 20221, 48 Fed. Reg. 45167, 45182 (Sept. 23, 1983).

209. See *id.*

210. See National Securities Clearing Corporation (“NSCC”); Order Approving Proposed Rule Change, Exchange Act Release No. 19705, 48 Fed. Reg. 20189, 20190 n.11 (Apr. 26, 1983) (“NSCC also was directed to establish appropriate free links with the Boston Stock Exchange Clearing Corporation (“BSECC”) and the now-deregistered TAD Depository Corporation . . . BSECC is now linked with, and is a participant in, NSCC.”).

211. See Full Registration as a Clearing Agency; Boston Stock Exchange Clearing Corp.; Order, Exchange Act Release No. 21335, 49 Fed. Reg. 37879, 37879 (Sept. 20, 1984).

2. *San Francisco*

The Pacific Exchange (PCX) in San Francisco was the next regional player to suffer the BSE's fate. Like the BSE, the clearing and depository functions of the PCX had historically been performed by two dedicated subsidiaries: the Pacific Clearing Corporation (PCC) and the Pacific Securities Depository Trust Company (PSDTC). However, unlike Boston's clearinghouse and depository, PCC and PSDTC received full registration from the SEC in 1983.²¹² Yet, just four years later, the PCX would also exit the clearing and depository businesses. And just like the BSE, the PCX would navigate this exit by outsourcing its clearing and depository functions to NSCC and DTC.

PCC and PSDTC exited the market in a series of incremental steps. The first step came in 1981 when PCC started using NSCC's proprietary over-the-counter (OTC) trade comparison and reconciliation system. Trade comparison is the process of matching trade details submitted by the buyer and seller to ensure that the parties agree on the price, the number of shares being purchased and sold, and other key terms. Until 1981, there were two competing OTC comparison and reconciliation systems available in the U.S. market. PCC operated one, which provided services both on its own behalf and on behalf of the Chicago and Philadelphia clearinghouses. NSCC operated the other.²¹³ On November 20, 1981, PCC decided to switch from its own proprietary system to the one operated by NSCC. Tellingly, the stated rationale for this switch was that it would "enhance the accuracy of OTC trade comparison and facilitate the resolution of un-compared trades."²¹⁴

The second step came in 1984, when the Municipal Securities Rulemaking Board, a self-regulatory organization (SRO) that oversees the market for municipal bonds, introduced a new rule requiring brokers to "use an automated comparison system for certain interdealer trades."²¹⁵ This rule sought to replicate the process that already existed for OTC transactions in other securities by centralizing and automating trade comparison and reconciliation. To comply with this rule, PCC decided to delegate to NSCC and DTC the responsibilities of clearing

212. See Depository Trust Co., et al.; Order, 48 Fed. Reg. at 45178.

213. See Midwest Clearing Corp. et al.; Filing of and Order Approving Proposed Rule Changes, Exchange Act Release No. 18277, 46 Fed. Reg. 58239, 58239 (Nov. 20, 1981).

214. *Id.*

215. Filing and Order Approving on an Accelerated Basis Proposed Rule Changes of Midwest Clearing Corporation and of Pacific Clearing Corporation, Exchange Release No. 21120, 49 Fed. Reg. 28490, 28490 (July 6, 1984).

and settling municipal securities.²¹⁶ Once again, rather than develop the technological infrastructure necessary to expand its clearing and depository businesses to the multi-trillion-dollar municipal-debt market, PCC decided to outsource these functions to its biggest competitors. For the next three years, this yielded a somewhat unusual arrangement whereby PCC and PSDTC cleared and settled most transactions executed on the PCX, while simultaneously relying on NSCC and DTC to clear and settle transactions in municipal securities.²¹⁷

Crucially, even where brokers were still clearing and settling trades on the PCX's own back-office infrastructure, PCC and PSDTC often failed to offer an alternative to NSCC and DTC. To comply with the SEC's interface requirement, PCC and PSDTC implemented what was known as the National Institutional Delivery System (NIDS).²¹⁸ NIDS was the interface that connected PCC and PSDTC to DTC's system, enabling them to automatically clear and settle trades with participants of DTC and other registered clearinghouses and depositories.²¹⁹ The process envisioned by NIDS was extremely cumbersome. To match buy and sell orders, exchanges sent trade data to one clearinghouse for comparison and settlement.²²⁰ But when a PCC member broker executed a trade on any exchange other than the PCX, PCC and PSDTC had to relinquish responsibility

216. *See id.* The Midwest Clearing Corporation (MCC) made the same decision. *See id.* ("In addition to providing services to its own participants, NSCC will be providing centralized, automated comparison services to other clearing agencies for municipal securities trade data submitted to NSCC by those clearing agencies on behalf of their participants. MCC's and PCC's [Pacific Clearing Corporation's] proposals would establish systems at those clearing corporations for submitting their participants' municipal securities trades to NSCC for automated comparison processing and producing participant reports based on trade data returned from NSCC." (footnote omitted)).

217. MCC was in the same position for twelve years. *See infra* Section II.C.3.

218. *See* Pacific Securities Depository Trust Co.; Order Approving Proposed Rule Change, Exchange Act Release No. 19437, 48 Fed. Reg. 3441, 3441 (Jan. 18, 1983).

219. *See id.* PCC also filed a rule change with the SEC that allowed PCC to develop a system "to receive trade data from, and transmit reports regarding that data to, the National Association of Securities Dealers, Inc. in connection with its Trade Acceptance and Reconciliation Service." Filing and Immediate Effectiveness of Proposed Rule Change by Pacific Clearing Corporation, Exchange Act Release No. 19199, 26 SEC Docket 726, 1982 WL 522121, at *1 (Nov. 1, 1982).

220. *See* Pacific Securities Depository Trust Co.; Order Approving Proposed Rule Change, 48 Fed. Reg. at 3441 ("For institutional trades among PSDTC members in PSDTC-eligible securities, PSDTC processes trade data provided by PSDTC member brokers to generate confirmations. These confirmations are distributed to interested member brokers, agent banks and institutions. If a confirmation accurately represents a trade ordered by the institution, either the agent bank or the institution (depending on their arrangement) affirms the trade and notifies PSDTC.").

for clearing and settling the trade to NSCC and DTC.²²¹ In practice, this meant that PCC submitted information about the trade to NSCC, and PSDTC submitted information to DTC. NSCC and DTC then cleared the transaction, updated DTC's book-entry system, and submitted the information back to PCC and PSDTC, which would update their own accounts and ensure final settlement.²²²

This process was remarkable for at least two reasons. First, it was circuitous. Trade information was relayed from regional clearinghouses and depositories to NSCC and DTC and then back again. Second, even when PCC and PSDTC were nominally providing clearing and depository services, they were effectively forced to rely on NSCC and DTC to undertake the majority of the work. The interface forced PCC and PSDTC to provide the exact same service as NSCC and DTC since the regional clearinghouse and depository were built on top of NSCC

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221. *See id.* (“For institutional trades involving participants in both PSDTC and DTC, PSDTC gathers trade data and affirmations through NIDS [National Institutional Delivery System] from PSDTC participants and, through the DTC ID System and the PSDTC-DTC interface, from DTC. PSDTC disseminates that information to the appropriate PSDTC participants and transmits the necessary data to DTC for dissemination through DTC’s ID System to appropriate DTC participants. Security delivery obligations and money payments settle through the DTC-PSDTC interface with credits or debits to appropriate accounts. Trades that are to be settled through the DTC-PSDTC interface will be settled on a trade-for-trade basis. Linking NIDS and the ID System also will enable PSDTC participants to deliver and receive confirmations and affirmations regarding trades involving PSDTC participants and participants in either the Philadelphia Depository Trust Company (‘Philadep’) or the Midwest Securities Trust Company (‘MSTC’). These trades, however, are not eligible currently for settlement through NIDS or other institutional delivery systems because the third party inter-depository interfaces (which are used to settle, by book-entry movement, trades involving participants that are members of different depositories) do not currently provide direct links among PSDTC, Philadep and MSTC. Instead, the current system links PSDTC, Philadep and MSTC to DTC as a spoke to a hub. Thus, PSDTC participants who are parties to a trade involving participants in Philadep or MSTC must make independent arrangements for the delivery of the securities either by physical delivery of certificates or by a Miscellaneous Delivery Order through the third party inter-depository interfaces linking the various depositories to DTC.”).
222. *See id.* For additional background on the NIDS interface developed by PCC and PSDTC as well as the costs of building a registration system, see Depository Trust Company; Order Approving Proposed Rule Change, on a Temporary Basis, Instituting Same-Day Funds Settlement Service, Exchange Act Release No. 24689, 52 Fed. Reg. 26613, 26616 nn.20-21 (July 15, 1987); Securities Transactions Settlement, Securities Act Release No. 8398, Exchange Act Release No. 49405, Investment Company Act Release No. 26384, 69 Fed. Reg. 12922, 12933-34 (Mar. 18, 2004); Transfer Agents Operating Direct Registration System, Exchange Act Release No. 35038, 58 SEC Docket 344, 1994 WL 681687 (Dec. 1, 1994); Ralph C. Ferrara & Konrad S. Alt, *Immobilization of the Security Certificate: The U.S. Experience*, 15 SEC. REGUL. L.J. 228, 235-42 (1987); New York Stock Exchange, Inc., et al.; Order Approving Proposed Rule Changes, 47 Fed. Reg. 51658, 51659-60 (Nov. 9, 1982); and JERRY W. MARKHAM & THOMAS LEE HAZEN, 23A BROKER-DEALER OPERATIONS UNDER SECURITIES AND COMMODITIES LAW § 13:5 (perm. ed., rev. vol. 2021).

and DTC's existing network infrastructure.²²³ The interface, in other words, hardly operated as an interface at all. PCC and PSDTC simply corresponded with NSCC and DTC while allowing the larger clearinghouse and depository to clear and settle transactions. Thus, rather than eliminating redundancies, the SEC-mandated interface created them.

In the end, this interface undercut the ability of PCC and PSDTC to compete with their larger and more sophisticated rivals. Rather than enabling them to develop and offer a competitive suite of products and services, the interface effectively forced the PCX and other regional exchanges to offer their customers a more cumbersome way of accessing the infrastructure already built by NSCC and DTC. Perhaps not surprisingly, this had the effect of further consolidating NSCC and DTC's growing market power. By the spring of 1987, DTC commanded approximately eighty-seven percent of the U.S. depository market, dwarfing the four percent market share of the PSDTC.²²⁴

Ultimately, for open access and interoperability to offer an alternative to monopoly, they must leave some room for firms to distinguish their products and services from those of their competitors. But here, interoperability effectively forced firms not only to use, but to *rely* on their rivals' infrastructure. Thus, the very regulations designed to prevent any single firm from obtaining a monopoly priced the PCX out of the market and consolidated NSCC and DTC's emerging status as dominant industry players.

The final nail in the coffin came in April 1987 when the PCX disclosed its intention to sell its struggling clearing and depository businesses.²²⁵ As explained by PCX Chairman Maurice Mann after the decision was announced:

223. The SEC described these redundancies when PCC and PSDTC finally transferred control over their clearing and custodial operations to NSCC and DTC in 1987. See Order Approving Rule Change by Pacific Clearing Corporation, Exchange Act Release No. 23726, 51 Fed. Reg. 37804, 37805 (Oct. 17, 1986) ("In order to match up buy and sell orders and to minimize non-compared trades, a stock exchange usually sends its trade data to one clearing agency for trade comparison and settlement. Trades executed on the NYSE or AMEX routinely are sent to NSCC. In order to clear a trade executed on the NYSE or AMEX, therefore, the exchange member must either be an NSCC member or 'give up' the trade to another exchange member who is an NSCC member. Currently, a PCC member who is a member of NYSE or AMEX but is not a member of NSCC (a 'non-clearing broker') must 'give up' a trade executed on NYSE or AMEX by substituting for the PCC member the name of an NSCC member (a 'clearing broker') who will clear and settle the trade for the PCC member. For example, if a non-clearing broker (a PCC member) executes a buy order on the floor of the exchange, the PCC member must 'give up' the name of a clearing broker so the trade can be processed by NSCC. When NSCC receives the pertinent transactional information, trade comparison occurs as if the clearing broker executed the trade. The clearing broker also submits a buy order to NSCC with the PCC member as the contra party.").

224. Robert Luke, *Exchange to Sell Nontrading Units*, AM. BANKER, Apr. 27, 1987, at 10, LEXIS.

225. See *id.*

“The clearing and depository operations have not been profitable for several years . . . Resources diverted to support these activities can now be applied to the main purposes of the exchange – its trading function.”²²⁶ Among the rationales for the sale was that PCC and PSDTC would have needed to make a “tremendous investment in technology”²²⁷ to compete with DTC’s “sophisticated computer system.”²²⁸ As one observer put it, the PCX “faced the prospect of spending millions of dollars over the next several years to upgrade its clearing and depository systems to match those of New York’s Depository Trust Co.”²²⁹ Rather than make these investments, the PCX ultimately decided to shutter its clearing and depository operations and transfer them to NSCC and DTC.²³⁰

3. Chicago

While the PCX was struggling to modernize its securities clearing and settlement systems, business was booming in Chicago. In 1985, the Midwest Stock Exchange (CHX)²³¹ posted net income of \$3.7 million on a surge in trading volumes to 1.85 billion shares, moved into a custom-built new trading facility, and surpassed the Amex to become the nation’s second-busiest stock market behind the NYSE.²³² Later that year, these developments would enable incoming CHX President Charles Doherty to strike a confident tone. He stated that “[t]he securities industry is changing rapidly, and the Midwest [Stock Exchange], which doesn’t have the excess baggage of other exchanges, has the flexibility to adapt quickly without disrupting its stature.”²³³

226. *Id.*

227. Robert Luke, *Pacific Stock Exchange Wants to Shed Its Clearing and Depository Business*, AM. BANKER, Apr. 21, 1987, 1987 WLNR 568095 (quoting Basil Schwan, assistant executive officer of the California Public Employees’ Retirement System).

228. *Id.* (quoting Anthony L. Torrance, PSDTC’s president and chief executive officer).

229. *Id.*

230. See *Annual Report 1987*, THE DEPOSITORY TR. CO. 25 (1987), http://3197d6d14b5f19f2f440-5e13d29c4c016cf96cbbfd197c579b45.r81.cf1.rackcdn.com/collection/papers/1980/1987_0101_DTCCAR.pdf [<https://perma.cc/KLN2-NC8C>].

231. The Midwest Stock Exchange changed its name to the Chicago Stock Exchange (CHX) in 1993. See Barnaby J. Feder, *Chicago (Midwest) Market Dusts Off Its Original Name*, N.Y. TIMES (July 8, 1993), <https://www.nytimes.com/1993/07/08/business/chicago-midwest-market-dusts-off-its-original-name.html> [<https://perma.cc/FJ97-XBNN>].

232. See Laurie Cohen, *The Midwest: A New Home, Higher Profile*, CHI. TRIB., Apr. 29, 1985, 1985 WLNR 862293.

233. William Gruber, *3D Career Is a Major Exchange*, CHI. TRIB. (Nov. 11, 1985, 12:00 AM), <https://www.chicagotribune.com/news/ct-xpm-1985-11-11-8503180223-story.html> [<https://perma.cc/8UT5-4G6B>].

While Doherty was correct that U.S. securities markets would undergo dramatic changes over the next decade, these changes ultimately contributed to the decline of the CHX and its clearing and depository business. One of the principal catalysts of these changes was the stock-market crash of October 19, 1987. Known as “Black Monday,” the crash saw the Dow Jones Industrial Average decline by 22.6% in a single day²³⁴ – the largest one-day percentage decline in the 125-year history of the venerable index. As a point of comparison, the worst one-day drop during the Great Depression was nearly 13%.²³⁵

While clearinghouses generally performed well during the crash,²³⁶ Black Monday did reveal that the regional players were vulnerable to market disruptions. Specifically, despite having developed a technological interface with NSCC and DTC, the regional exchanges struggled to process the sheer volume of transactions triggered by the crash. In particular, trade-comparison processes became a major “stress point,” leading to late payments and increased error rates.²³⁷ Indeed, the week after the crash, the NASD was forced to shorten the trading day by two hours to give clearinghouses and depositories more time to correct errors and clear the backlog of executed but unsettled trades.²³⁸ The crash also tested the ability of clearinghouses to monitor the financial condition of member brokers and to manage member defaults.²³⁹ As the SEC stated in its subsequent report, the crash thus “highlighted the need for further automation in the trade comparison and resolution process and improved capacity and flexibility in existing systems.”²⁴⁰

The crash also highlighted how consequential a clearinghouse failure would be to market stability. Gerald Corrigan, President of the Federal Reserve Bank of New York, observed that “[t]he greatest threat to the stability of the financial

234. Kimberly Amadeo, *How Does the 2020 Stock Market Crash Compare with Others?*, BALANCE (May 4, 2022), <https://www.thebalance.com/fundamentals-of-the-2020-market-crash-4799950> [<https://perma.cc/5GPW-HF88>].

235. *See id.*

236. *See* DIV. OF MKT. REGUL., U.S. SEC. & EXCH. COMM’N, THE OCTOBER 1987 MARKET BREAK 10-21 (1988) (“Clearing agency systems for monitoring member financial condition and managing member defaults were tested by the extreme volatility and volume of the recent October market break. Overall, the clearing agencies handled well the actual and potential member defaults; in general, the clearing agencies were able to spot potential member defaults and follow them until the situation eased or the member ceased doing business. Clearing agency monitoring and communication among clearing agencies enabled them to minimize or eliminate loss.”).

237. *Id.* at 10-5; *see also id.* at 10-15 to 10-16 (describing the frequency of late payments in October 1987).

238. *See id.* at 10-1.

239. *See id.* at 10-13, 10-21.

240. *Id.* at 10-2.

system as a whole in that period was the danger of a major default in one of these clearing and settlement systems.”²⁴¹ Federal Reserve Board Chairman Alan Greenspan took a similar position, stating that “[t]he overloading of the . . . clearing systems last October [1987] induced breakdowns that dramatically increased uncertainty among investors and likely contributed to additional downward pressures on prices.”²⁴² The United States General Accounting Office summarized the clearing deficiencies that contributed to the crisis: “Because of the extraordinary trading volume and market volatility, trade processing systems became backlogged and were not able to process trade data on time.”²⁴³

After the crash, an international organization known as the Group of Thirty, which was established to study securities clearing and settlement, made nine recommendations for improving these processes.²⁴⁴ The group recognized that serious deficiencies in the U.S. securities clearing and settlement system stemmed from the length of time it took to clear and settle trades.²⁴⁵ At the time of the crash, the period between the execution of a trade and final settlement was typically five days, known in industry parlance as T+5. The group therefore recommended that clearinghouses move to three-day settlement (T+3) for the delivery of equity securities to the buyer and same-day settlement (T+0) for payment to the seller.²⁴⁶

241. E. Gerald Corrigan, Luncheon Address: Perspectives on Payment System Risk Reduction, *in* THE U.S. PAYMENT SYSTEM: EFFICIENCY, RISK AND THE ROLE OF THE FEDERAL RESERVE 129, 129-30 (David B. Humphrey ed., 1990).

242. Securities Transactions Settlement, Securities Act Release No. 7022, Exchange Act Release No. 33023, Investment Company Act Release No. 19768, 58 Fed. Reg. 52891, 52893 (Oct. 6, 1993) (quoting Alan Greenspan, Chairman, Bd. of Governors of the Fed. Rsrv. Sys., Remarks Before the Annual Convention of the Securities Industry Association (Nov. 30, 1988)).

243. U.S. GEN. ACCT. OFF., GAO/GGD-90-33, CLEARANCE AND SETTLEMENT REFORM: THE STOCK, OPTIONS, AND FUTURES MARKETS ARE STILL AT RISK 24 (1990), <http://archive.gao.gov/d24t8/141098.pdf> [<https://perma.cc/42JB-LVTX>].

244. See Report of the Bachmann Task Force on Clearance and Settlement Reform in U.S. Securities Markets, Exchange Act Release No. 30802, 57 Fed. Reg. 27812, 27815 (June 15, 1992).

245. See *id.* at 27818.

246. See *id.* (noting the Group of Thirty’s recommendation to shorten the settlement cycle from T+5 to T+3); see also *id.* at 27822 (noting the Group of Thirty’s recommendation for same-day funds payment). A 1992 taskforce report expounded on the Group of Thirty’s proposals. The taskforce report recommended achieving T+3 settlement by requiring book-entry settlement between financial intermediaries and their institutional clients as well as depository eligibility for all new issuances. See Report of the Bachmann Task Force on Clearance and Settlement Reform in U.S. Securities Markets, 57 Fed. Reg. at 27814. In the late 1990s, transactions in equities, corporate debt, and municipal debt were settled in “next-day funds,” which meant that, after a clearinghouse had fully validated a transaction, the trade was settled with funds that became available the next day. This usually occurred by means of certified checks that are for value on the following day. Transactions in commercial paper and other money-market

Over the next decade, the SEC, NSCC, and DTC worked to implement these recommendations. In 1993, the SEC adopted Rule 15c6-1, which prohibited brokers and dealers from “provid[ing] for payment of funds and delivery of securities later than the third business day after the date of the contract.”²⁴⁷ When the rule went into effect in 1995, DTC and NSCC converted to T+3 securities and same-day funds settlement.²⁴⁸ Unsurprisingly, shortening the timeframe for securities and funds settlement required significant investments in technological and operational infrastructure.²⁴⁹

These changes revolutionized securities trading. They also contributed to the demise of the CHX’s clearing and depository subsidiaries, Midwest Clearing Corporation (MCC) and Midwest Securities Trust Company (MSTC). In the immediate aftermath of the crash, the CHX had tried to expand its market footprint by offering its own depository services directly to brokerage firms and other institutional investors.²⁵⁰ Yet, by 1991, slower trading volumes—more than twenty percent off their precrash peak—had forced MSTC to lay off forty-eight of its approximately three hundred fifty employees.²⁵¹ While the CHX

instruments were already settled in same-day funds. See Order Granting Accelerated Approval of a Proposed Rule Change Modifying the Same-Day Funds Settlement System, Exchange Act Release No. 35720, 60 Fed. Reg. 27360 (May 16, 1995) (granting accelerated approval to a proposed rule change modifying the same-day funds-settlement system).

247. Securities Transactions Settlement, 58 Fed. Reg. at 52903.

248. The two proposals were related. When the SEC was promulgating the T+3 settlement rule, DTC and NSCC submitted a comment stating that they “believe that the proposed arrangements will facilitate the industry’s planned conversion to same-day funds settlement.” Order Approving Proposed Rule Changes Regarding Arrangements Relating to a Decision by the Chicago Stock Exchange, Incorporated to Withdraw from the Clearance and Settlement, Securities Depository, and Branch Receive Businesses, Exchange Act Release No. 36684, 61 Fed. Reg. 1195, 1196 (Jan. 5, 1995); see also *Annual Report 1995*, DTC 7 (1995), http://3197d6d14b5f19f2f440-5e13d29c4c016cf96cbbfd197c579b45.r81.cf1.rackcdn.com/collection/papers/1990/1995_0101_DTCAR.pdf [<https://perma.cc/TV8V-FNXX>] (“The conversion to T+3 settlement last June and the subsequent move to all same-day funds settlement are transforming how self-regulatory organizations, banks, and broker-dealers operate in fundamental ways.”).

249. See Securities Transaction Settlement Cycle, Exchange Act Release No. 80295, 82 Fed. Reg. 15564, 15575 (Mar. 22, 2017) (describing the technological and infrastructure investments needed to reduce settlement times).

250. See Diana B. Henriques, *Depository Skirts Bank Middlemen*, N.Y. TIMES (Nov. 28, 1989), <https://www.nytimes.com/1989/11/28/business/market-place-depository-skirts-bank-middlemen.html> [<https://perma.cc/654C-ZHYC>].

251. See William B. Crawford, Jr., *Midwest Exchange Affiliate Lays Off 48*, CHI. TRIB. (Aug. 30, 1991, 12:00 AM), <https://www.chicagotribune.com/news/ct-xpm-1991-08-30-9103040876-story.html> [<https://perma.cc/V9JL-KS8N>]; Charles Storch, *Chief Quits at Midwest Exchange*, CHI. TRIB. (Mar. 25, 1992, 12:00 AM), <https://www.chicagotribune.com/news/ct-xpm-1992-03-25-9201270729-story.html> [<https://perma.cc/ZE4Z-7FP3>] (reporting the drop in average daily trading volumes over the preceding year).

would attempt to resuscitate this business in 1995,²⁵² by this point the die had already been cast.

On September 20, 1995, the CHX announced that it was selling MCC and MSTC to NSCC and DTC for twenty-two million dollars.²⁵³ Echoing the PCX's stated rationale for exiting the clearing and depository businesses, CHX President Robert Forney explained that "[t]o prosper in a rapidly evolving and fiercely competitive trading business, the exchange must streamline and focus on a core mission: trading securities."²⁵⁴ The move was estimated to result in the elimination of two hundred fifty to three hundred back-office jobs.²⁵⁵ It was also accompanied by a fifty percent reduction in the CHX's operating budget, along with a reported shift in the exchange's focus to "less expensive" projects.²⁵⁶ In the wake of the CHX's announcement, the *Chicago Sun-Times* quoted a member of the Chicago Stock Exchange, who said: "This will end Chicago's history as a securities processing center, and it leaves the exchange an empty shell . . ."²⁵⁷ Importantly, it also left NSCC and DTC responsible for over ninety-seven percent of the U.S. equity clearing and depository markets.²⁵⁸

The CHX's decision to exit the securities clearing and depository businesses appears to have been a function of at least three intertwined variables. The first was the escalating technological costs of keeping pace with the NYSE and

252. See William B. Crawford, Jr., *Chicago Exchange Creates Certificate-Processing Unit*, CHI. TRIB. (May 18, 1995, 12:00 AM), <https://www.chicagotribune.com/news/ct-xpm-1995-05-18-9505180368-story.html> [<https://perma.cc/H3EL-78RC>].

253. See *Clearinghouse Services to Go; Chicago Stock Exchange*, CHI. TRIB., Sept. 21, 1995, at A3, LEXIS. At the time of the sale, DTC was reported to have approximately \$9.1 trillion worth of assets in custody versus \$130 billion for MSTC. See *id.* The CHX then became a member of both NSCC and DTC, thereby outsourcing its clearing and depository functions. See Order Approving Proposed Rule Changes Regarding Arrangements Relating to a Decision by the Chicago Stock Exchange, Incorporated to Withdraw from the Clearance and Settlement, Securities Depository, and Branch Receive Businesses, 61 Fed. Reg. at 1196 ("CHX will assist members of MCC and MSTC to find substitute service providers including other registered clearing agencies and will develop plans to assist floor brokers and specialists to obtain access to NSCC and DTC services by pursuing arrangements with those organizations similar to the arrangements structured by the Pacific and Boston Stock Exchanges.").

254. William Smith, *Taking Stock; New Chicago Exchange Boss Plays Catch-up with Nasdaq*, CHI. SUN-TIMES, Oct. 1, 1995, at 39, LEXIS.

255. See William Smith, *Chicago Stock Exchange Will Sell 3 Units; 300 Jobs to Go*, CHI. SUN-TIMES, Sept. 21, 1995, at 55, LEXIS.

256. George Gunset, *Trading in Old Reputation; Chicago Stock Exchange's High-Tech Flair May Snare Locals*, CHI. TRIB., Feb. 19, 1996, at B1, LEXIS.

257. Smith, *supra* note 255.

258. See Daniel Dunaief, *Midwest Consolidation May Raise Banks' Cost of Settling Trades*, AM. BANKER, Sept. 29, 1995, at 24, LEXIS.

Nasdaq—both of which used NSCC and DTC to clear and settle trades and, importantly, to implement the shift to T+3 securities settlement and same-day funds settlement.²⁵⁹

The second reason was that the SEC-mandated interfaces with NSCC and DTC created new risks that the regional clearinghouses and depositories were then forced to manage. As the CHX explained in a comment letter to the SEC following the announcement of the sale of its clearing and depository businesses: “[W]here there are interfaces between securities depositories, and interfaces among the securities clearing corporations, same-day funds settlement exposes each depository or clearing corporation to certain risks.”²⁶⁰ Specifically, the CHX was concerned that the failure of one clearinghouse or depository to settle its obligations to other network participants could jeopardize the ability of these other participants to meet their own payment obligations.²⁶¹ The CHX thus highlighted the risk that the interconnections created by SEC-mandated interoperability could lead to a cascading series of clearinghouse failures. On this basis, the CHX concluded that its withdrawal from the clearing and depository businesses would “eliminate the exposure of DTC and its participants and NSCC and its participants to the payment system risks associated with the DTC-MSTC and NSCC-MCC interfaces.”²⁶²

The essence of the CHX’s concern was that fragmented clearing and depository markets would fare worse than concentrated markets at managing and mitigating counterparty credit risk. If a clearinghouse or depository failed, its failure would be destabilizing and could lead to a wider panic. As we have already seen, to prevent failure, clearinghouses and depositories require members to post collateral and contribute to dedicated default funds that can be drawn upon in times of institutional instability and crisis.²⁶³ All other things being equal, this means that *larger* clearinghouses and depositories—with more members, more collateral, and more capital—should be better positioned to weather financial storms. By exiting the market and transferring its business to NSCC and DTC, the CHX

259. See Smith, *supra* note 254.

260. Order Approving Proposed Rule Changes Regarding Arrangements Relating to a Decision by the Chicago Stock Exchange, Incorporated to Withdraw from the Clearance and Settlement, Securities Depository, and Branch Receive Businesses, Exchange Act Release No. 36684, 61 Fed. Reg. 1195, 1196 (Jan. 5, 1995).

261. See *id.* (“These include risks such as the failure of another depository or clearing corporation to settle its new payment obligation because of a failure by one of the participants of such other depository or clearing corporation to settle with it or because such other depository or clearing corporation is experiencing a major system problem.”).

262. *Id.*

263. See *supra* notes 170–171 and accompanying text.

thus buttressed the resilience of the U.S. securities clearing and depository industries.

Lastly, as MCC and MSTC themselves pointed out, the SEC's interoperability requirements were the source of exceedingly high and often duplicative costs. When MCC requested SEC approval to cease providing clearing and custodial services, it observed that "interdepository and interclearing corporation interfaces involve the maintenance of substantial facilities, communications networks, and account and inventory reconciliation mechanisms[.] As a result of the proposal the SROs believe the substantial costs incurred by both DTC and MSTC and by NSCC and MCC in operating their interfaces would be eliminated."²⁶⁴ Using virtually identical language, MSTC argued that the existence of multiple depositories led to costly and duplicative systems, explaining that "interdepository and clearing interfaces involve the maintenance of substantial facilities, communications networks, and account and inventory reconciliation mechanisms. As a result of the proposal, the substantial costs incurred by both DTC, NSCC, MCC, and MSTC in operating interfaces would be eliminated."²⁶⁵

The crucial point here is that SEC-mandated interoperability meant that decisions spearheaded by NSCC and DTC regarding network innovation and investment ended up dictating the nature, timing, and size of the infrastructure costs incurred by the CHX and other regional exchanges. For example, when NSCC and DTC moved to T+3 securities settlement and same-day funds settlement, the SEC's interoperability requirements compelled MCC and MSTC to update their technological and operational systems to accommodate these changes. Failure to do so would have prevented trades from settling within the new, faster timeframes – thus rendering the CHX's clearing and depository services incompatible with NSCC and DTC's platforms. As a result, when NSCC

²⁶⁴. Order Approving Proposed Rule Changes Regarding Arrangements Relating to a Decision by the Chicago Stock Exchange, Incorporated to Withdraw from the Clearance and Settlement, Securities Depository, and Branch Receive Businesses, 61 Fed. Reg. at 1196; *see also id.* at 1196 n.12 ("Because CHX no longer will be operating a securities depository, certain changes will be required in DTC procedures, principally the elimination of fourth-party deliveries between MSTC participants and Philadep participants through the interfaces that DTC has maintained with MSTC and Philadep. MSTC and Philadep never established their own interface. In addition, the SROs noted that dual DTC/MSTC and dual NSCC/MCC participants would achieve special savings by discontinuing their payment of MSTC and MCC fees for largely redundant processing costs related to securities clearing and settlement. Furthermore, both DTC and NSCC anticipate an increase in the number of their participants. DTC and NSCC have stated that this increase will result in higher DTC and NSCC transaction volumes thereby reducing the per-unit service costs that must be recovered through DTC and NSCC participant service fees.").

²⁶⁵. Notice of Filing of Proposed Rule Change Relating to Chicago Stock Exchange, Incorporated's Decision to Withdraw from the Clearance and Settlement and Securities Depository Businesses, Exchange Act Release No. 36509, 60 Fed. Reg. 61720, 61721 (Nov. 27, 1995).

and DTC made technological improvements, interoperability effectively forced their competitors to follow suit.

In the case of the CHX, open access and interoperability thus failed to replicate scale economies and led to costly and duplicative clearing and depository systems. In addition, these coordination requirements allowed the CHX's principal competitor to effectively dictate the pace of its technological investments. From this perspective, the sale of the CHX's clearing and depository businesses to NSCC and DTC likely improved the efficiency and stability of U.S. equity markets. But it also eliminated the last meaningful roadblock on NSCC and DTC's path to monopoly.

4. Philadelphia

Following the CHX's sale of MCC and MSTC, *American Banker* predicted that the transaction would give the Philadelphia Stock Exchange (PHLX) a "strategic advantage" as the only remaining alternative to the clearing and depository services provided by NSCC and DTC.²⁶⁶ The President of the PHLX seems to have agreed, observing shortly after the announcement of the sale that "[t]here are an awful lot of people who want a choice."²⁶⁷

The problem was that the PHLX's clearing and settlement operations—the Stock Clearing Corporation of Philadelphia (SCCP) and the Philadelphia Depository Trust Company (Philadep)—were nowhere near up to the challenge of competing with the scale or sophistication of NSCC and DTC. Echoing the 1960s Paperwork Crisis, the PHLX's clearing and settlement systems broke down in the middle of the trading day on at least two occasions in 1996.²⁶⁸ In April 1997, the *New York Times* reported the existence of a confidential letter from the SEC that "paint[ed] a picture of an organization with an inexperienced staff and antiquated computer system, and without the money to remedy either problem."²⁶⁹ The article further alleged that the exchange had improperly borrowed money from SCCP's accounts.²⁷⁰

266. Dunaief, *supra* note 258, at 24.

267. *Id.* (quoting Nick A. Giordano, president of the Philadelphia Stock Exchange).

268. See Joseph DiStefano, *Phila. Exchange to Sell Units*, PHILA. INQUIRER, May 22, 1997, at C1, LEXIS.

269. Leslie Eaton, *S.E.C. Inquiry at the Philadelphia Stock Exchange*, N.Y. TIMES (Apr. 19, 1997), <https://www.nytimes.com/1997/04/19/business/sec-inquiry-at-the-philadelphia-stock-exchange.html> [<https://perma.cc/8U5N-JR43>].

270. See *id.*

On June 18, 1997, SCCP and Philadep entered into an agreement with the SEC to cease providing clearing and depository services.²⁷¹ This agreement followed an SEC investigation that found, among other things, that SCCP and Philadep had failed to safeguard broker and client funds, follow margin requirements, or settle transactions in a timely manner.²⁷² Moreover, SCCP and Philadep reported that they lacked the resources to retain member data, compare trades, and develop information systems for communicating with NSCC and DTC.²⁷³ A few months after signing the agreement, SCCP and Philadep transferred their operations to NSCC and DTC, and in December 1997, the SEC approved the transfer, thereby formalizing “Philadep’s withdrawal from the depository business and temporarily approv[ing] . . . SCCP’s restructured and limited clearance and settlement business.”²⁷⁴ NSCC and DTC also placed three million dollars in a reserve fund and agreed to pay two million dollars for improvements to the firm’s data-processing systems.²⁷⁵ In stark contrast with the other regional clearinghouses and depositories, which all departed voluntarily, the PHLX was made to shutter its clearing and custodial businesses.

Ultimately, the PHLX could not afford to build the technological and operational infrastructure necessary to develop and offer state-of-the-art clearing and depository services. Of course, open access and interoperability were supposed to reduce these costs by allowing the regional players to rely on the infrastructure developed by NSCC and DTC. Nevertheless, SCCP and Philadep still had to develop technological capabilities to comply with increasingly onerous clearing and depository rules and to connect with NSCC and DTC’s platforms. In the end, the SEC found that the PHLX’s clearing and depository operations simply lacked the resources to do so.²⁷⁶

Compounding matters, like PCC and MCC, SCCP and Philadep used NIDS to interface with NSCC and DTC when comparing and recording trades that

271. See Stock Clearing Corp. of Phila., Exchange Act Release No. 38918, 1997 WL 457495, at *8 (Aug. 11, 1997).

272. See *id.* at *2-8 (listing nine ways the Stock Clearing Corporation of Philadelphia and the Philadelphia Depository Trust Company failed to comply with recordkeeping, margin, and valuation requirements).

273. See *id.* at *3.

274. Order Approving a Proposed Rule Change Relating to Permanent Approval of SCCP’s Restructured Limited Clearing Business, Exchange Act Release No. 48954, 68 Fed. Reg. 75013, 75014 (Dec. 18, 2003).

275. See Tom Belden, *Units of Philex Settle Charges*, PHILA. INQUIRER, Aug. 12, 1997, at C1, LEXIS.

276. See Eaton, *supra* note 269.

involved multiple clearinghouses.²⁷⁷ In addition to building the communications infrastructure necessary to interface with NSCC and DTC, SCCP thus had to use the infrastructure developed by its principal competitors to clear a large proportion of its trades. Like PCC and MCC, the PHLX's customers were riding on NSCC and DTC's rails. But doing so ensured that the regional clearinghouses and depositories offered essentially the same services as did DTC and NSCC, leaving SCCP and Philadep little scope to distinguish themselves from their competitors. Little wonder, then, that SCCP and Philadep ultimately lost market share.

With the acquisition of SCCP and Philadep, NSCC and DTC had effectively established a monopoly over U.S. equity clearing and depository markets. As it turned out, market participants were less interested in having a choice than they were in having modern and dependable financial-market infrastructure.

* * *

At the very least, NSCC and DTC's more or less unobstructed path to monopoly makes it clear that SEC-mandated open access and interoperability failed to accomplish their stated goal of promoting competition within U.S. securities clearing and depository markets. Even more importantly, there is substantial evidence that open-access and interoperability requirements actually contributed to the decline and eventual exit of the regional clearinghouses and depositories. These requirements forced the regional players to incur the relatively high fixed costs of connecting to this new financial-market infrastructure. Whenever NSCC or DTC made improvements to their own infrastructure, these requirements left the regional firms with no other choice but to do the same. Interoperability thus allowed NSCC and DTC to dictate the pace of their smaller rivals' investments in innovation and forced the regional clearinghouses and depositories to make significant infrastructure investments.

At the same time, interoperability exposed clearinghouses and depositories to new risks. As highlighted by the 1987 stock-market crash, interoperability increased each regional player's exposure to the failure of other clearinghouses and depositories. Importantly, while mechanisms like collateral, capital, and dedicated default funds were designed to address these risks, the costs and effectiveness of these mechanisms were not shared equally by all firms. Instead, these mechanisms served to reinforce the advantages of scale, because firms with more collateral, more capital, and larger default funds were better able to absorb these

277. See Notice of Filing and Order Granting Accelerated Permanent Approval of a Proposed Rule Change Relating to Procedures for Inter-Depository Deliveries, Exchange Act Release No. 37617, 61 Fed. Reg. 46885, 46885 (Aug. 29, 1996).

risks. As a result, interoperability increased the risks that each regional player faced while simultaneously preventing them from fully capturing the scale economies that could help ensure their resilience during periods of institutional stress.

Lastly, because the SEC's open-access and interoperability requirements often contemplated that the regional clearinghouses and depositories would need to rely on NSCC and DTC's infrastructure, this left these smaller players with limited scope for product differentiation. While it seems unlikely that Boston, San Francisco, Chicago, or Philadelphia would have been able to offer superior products and services, they might have been willing and able to carve out a niche for providing lower quality, less expensive securities clearing, settlement, and custody. This, in turn, could have fostered more choice and, ultimately, greater competition. Yet, by requiring regional firms to use NSCC and DTC's rails, open access and interoperability effectively forced the regional clearinghouses and depositories to offer products and services that were virtually identical to those of their larger and more sophisticated competitors. It was a game they were never going to win.

D. The Aftermath

Predictably, once DTCC acquired complete control over U.S. securities clearing and depository markets, evidence began to emerge that it might have been abusing its dominant position. Until the late 2000s, the NYSE, NASD, and Amex collectively owned more than one-third of the shares in DTCC.²⁷⁸ As a result, the two dominant exchanges collectively owned a significant stake in the clearinghouse and depository businesses that, by 1997, served all their principal competitors. The other owner, NASD, was made up of the country's largest broker-dealers.²⁷⁹

The NYSE, Amex, and NASD appear to have used this position to advance their broader business interests. For example, in 2006, DTC proposed a rule that made it extremely difficult for nonmember transfer agents, regional exchanges, and brokers that were not members of the NASD to hold securities recorded on

278. See Order Approving Proposed Rule Changes to Require Members to Purchase Shares of the Common Stock of the Depository Trust & Clearing Corporation, Exchange Act Release No. 52922, 70 Fed. Reg. 74070, 74071 (Dec. 7, 2005) ("NYSE holds approximately 29% of the outstanding DTCC common shares, and the NASD and the AMEX each holds approximately 3.7%.").

279. See *National Association of Securities Dealers, Inc.*, NAT'L ASS'N OF SEC. DEALERS, INC. 2 (1997), <https://www.finra.org/sites/default/files/Corporate/p009762.pdf> [<https://perma.cc/XL2R-YGWY>].

DTC's book-entry system.²⁸⁰ In effect, the proposed rule, which the SEC approved in amended form,²⁸¹ forced these firms to choose between opening an account with DTC, creating their own infrastructure for electronically recording securities ownership, or simply exiting the marketplace.²⁸² This bleak calculus prompted at least one competitor to object that DTC was "seeking to become a de facto regulator of the entire transfer agent industry" and to argue that DTC was using its position as "a monopoly [to] engage[] in predatory, anti-competitive conduct with respect to its direct competitors."²⁸³

The competitors of the NYSE and Amex similarly complained that NSCC was engaged in anticompetitive pricing tactics.²⁸⁴ Importantly, as owners, the NYSE and Amex were not required to pay membership fees to NSCC. Simultaneously, the ability to make decisions about what membership fees to charge NSCC's customers gave these exchanges an enormous advantage—namely, the ability to dictate a significant component of their competitors' operating costs.²⁸⁵ One competitor, Nasdaq, even considered building its own securities clearinghouse to reduce the costs of clearing securities transactions.²⁸⁶ While Nasdaq ultimately abandoned this plan, it did so only after NSCC reduced prices in response to the prospect that Nasdaq would emerge as a competitor.²⁸⁷

In response to concerns about DTC and NSCC's anticompetitive behavior, the SEC eventually had to restructure the ownership and governance of DTCC.

280. See Notice of Filing of Proposed Rule Change Amending FAST and DRS Limited Participant Requirements for Transfer Agents, Exchange Act Release No. 55816, 72 Fed. Reg. 30648, 30648-51 (May 25, 2007).

281. See Order Granting Approval of a Proposed Rule Change as Amended Relating to FAST and DRS Limited Participant Requirements for Transfer Agents, Exchange Act Release No. 60196, 74 Fed. Reg. 33496, 33497 (June 30, 2009).

282. See Notice of Filing of Proposed Rule Change Amending FAST and DRS Limited Participant Requirements for Transfer Agents, 72 Fed. Reg. at 30648.

283. Steven Nelson, Chairman & President, Cont'l Stock Transfer & Tr. Co., Comment Letter on Proposed Rule Change Amending FAST and DRS Limited Participant Requirements for Transfer Agents 1, 3 (June 20, 2007), <https://www.sec.gov/comments/sr-dtc-2006-16/dtc200616-12.pdf> [<https://perma.cc/3P3L-64XP>].

284. See, e.g., Steve Swanson, Chief Exec. Officer & President, Automated Trading Desk, LLC, Comment Letter on Securities and Exchange Commission Release No. 34-53742, at 2 (May 30, 2006), <https://www.sec.gov/comments/sr-nssc-2006-04/sswanson1906.pdf> [<https://perma.cc/6SBH-96B7>].

285. See *id.*

286. See *Nasdaq Plans to Compete with the NSCC*, TRADERS MAG. (Oct. 16, 2008), <https://www.tradersmagazine.com/departments/clearing/nasdaq-plans-to-compete-with-the-nssc> [<https://perma.cc/5JWG-5B6R>].

287. See *Nasdaq OMX Abandons US CCP Plans*, TRADE (Oct. 30, 2009, 1:48 PM GMT), <https://www.thetradenews.com/nasdaq-omx-abandons-us-ccp-plans> [<https://perma.cc/3MFN-JG3Y>].

These reforms included making the NYSE and Amex sell their substantial ownership stake.²⁸⁸ As a result, DTCC is now mutually owned by over 250 of its member banks, brokers, and other financial institutions.²⁸⁹ Simultaneously, the governance of DTCC has been rebuilt to represent a wider spectrum of the financial-services industry, including “its financial institution participants, their issuer and investor clients and the governmental and supervisory authorities responsible for the global clearance and settlement systems.”²⁹⁰

Ultimately, once DTCC obtained a monopoly and started to take advantage of its position, the SEC felt compelled to take additional steps to prevent NSCC and DTC from extracting monopoly rents. Crucially, open-access and interoperability requirements were supposed to allow policymakers to avoid turning to more intrusive forms of monopoly regulation, such as price controls, strict regulatory oversight, or ownership changes. Yet, in the end, because SEC-mandated coordination failed to prevent NSCC and DTC from obtaining a monopoly, policymakers had to exert strict control over DTCC’s ownership and governance – including the radical step of forcing the NYSE to sell its ownership stake – in order to prevent these firms from abusing their dominant position.²⁹¹

III. POLICY IMPLICATIONS

The role of open-access and interoperability requirements in paving DTCC’s path to monopoly has important implications for both financial regulation and competition law. For financial regulation, our analysis suggests that policymakers should regulate clearinghouses and depositories extensively to mitigate market-power abuses. It also suggests that the realization of economies of scale, together with the SEC’s open-access and interoperability requirements, has changed and likely exacerbated the systemic risks posed by NSCC and DTC.

288. See Order Approving Proposed Rule Changes to Require Members to Purchase Shares of the Common Stock of The Depository Trust & Clearing Corporation, Exchange Act Release No. 52922, 70 Fed. Reg. 74070, 74071 (Dec. 7, 2005).

289. See *DTCC Common Stock Reallocation*, THE DEPOSITORY TR. CO. 3 (Mar. 28, 2018), <https://www.dtcc.com/-/media/Files/pdf/2018/3/28/7949-18.pdf> [<https://perma.cc/855M-5325>] (describing DTCC’s current governance structure).

290. Bd. of Dirs., *Mission Statement*, THE DEPOSITORY TR. & CLEARING CORP. 6-7 (Oct. 2021), <https://www.dtcc.com/-/media/Files/Downloads/legal/policy-and-compliance/DTCC-BOD-Mission-and-Charter.pdf> [<https://perma.cc/J8ZA-ET7Q>].

291. Notably, the clearinghouses that serve options and futures markets are privately owned, and American and European financial regulators have raised concerns that these clearinghouses are favoring their owner-exchanges. See *Comments of the United States Department of Justice: Review of the Regulatory Structure Associated with Financial Institutions*, U.S. DEP’T JUST. 6-9 (Jan. 31, 2008), <https://www.justice.gov/atr/comments-united-states-department-justice-review-regulatory-structure-associated-financial> [<https://perma.cc/AY2Q-U7CS>].

For competition law, our analysis provides a cautionary tale about the logic and limits of coordination requirements. This cautionary tale could hardly come at a better time. In October 2020, the U.S. House of Representatives released a report that embraced open access and interoperability as a centerpiece of any future attempt to mitigate the growing market power of large technology platforms like Amazon, Google, and Facebook.²⁹² And on the other side of the Atlantic, coordination requirements have been a key pillar in the European Union's attempt to build a single Capital Markets Union.²⁹³ Our analysis suggests that regulators should proceed carefully and that open access and interoperability will not always be an effective way to capture scale economies, promote competition, or constrain market-power abuses.

A. *Interoperability and Financial Stability*

The changing structure of U.S. securities clearing and depository markets sheds new light on the relationship between interoperability and systemic risk. As described in Part II, interoperability necessitated that NSCC, DTC, and the regional clearinghouses and depositories be able to transact with each other. This, in turn, exposed each clearinghouse and depository to the failure of its principal competitors. By increasing the level of *interconnectedness* within securities clearing and depository markets, interoperability thus increased the risk of *contagion* and, with it, the prospect of a cascading series of clearinghouse and clearing-member defaults.

In the short term, this fragmented yet highly interconnected market structure meant that firms other than NSCC and DTC were unable to capture the economies of scale that would have enabled them to manage these potential threats to financial stability more effectively. Over the longer term, of course, interoperability was also an important driver of the shift away from this fragmented industry structure and toward DTCC's current monopoly. Crucially, this shift in industry structure has been accompanied by a parallel shift in the nature

292. See MAJORITY STAFF OF THE SUBCOMM. ON ANTITRUST, COM. & ADMIN. L. OF THE H. COMM. ON THE JUDICIARY, 116TH CONG., INVESTIGATION OF COMPETITION IN DIGITAL MARKETS: MAJORITY STAFF REPORT AND RECOMMENDATIONS 384-86 (2020).

293. See Directive 2014/65/EU, of the European Parliament and of the Council of 15 May 2014 on Markets in Financial Instruments and Amending Directive 2002/92/EC and Directive 2011/61/EU, arts. 37, 51, 2014 O.J. (L 173) 1; see also *Open Access: Myth-Busting*, LONDON STOCK EXCH. GRP., <https://web.archive.org/web/20210302132246/https://www.lseg.com/resources/open-access/open-access-myth-busting> [https://perma.cc/G6FP-TA4M] ("We believe customers should have the ultimate choice in where they take their business. That's why we welcome the European Union's determination to introduce an Open Access model, via MiFID II that gives investors transparency, competition and better risk management.").

of the systemic threats. Specifically, rather than interconnectedness and contagion, the systemic risks within U.S. securities clearing and depository markets now stem from the fact that NSCC and DTC have become too big to fail.

As described by the Financial Stability Board, the global oversight body for systemic risk, the too-big-to-fail problem arises whenever the threat that a financial institution might fail poses the risk – owing to its “size, interconnectedness, complexity, cross-border activity or lack of substitutability” – of wider financial instability or economic disruption.²⁹⁴ This threat then pressures public authorities to intervene, and specifically to use public funds to bail out these financial institutions in times of systemic stress.²⁹⁵ Solving the too-big-to-fail problem is one of the most controversial and thorny challenges in financial regulation. Faced with the impending failure of a systemically important firm, governments possess a distinctly limited range of policy options. First, the government can identify a private party, typically a competitor, willing to take on the debts of the failing firm. This is how the U.S. government responded to the failures of both Bear Stearns and Wachovia during the global financial crisis.²⁹⁶ Second, the government can itself agree to guarantee or pay the firm’s debts, either to prevent the firm from failing or to prevent a cascading failure of other systemically important firms.²⁹⁷ This is the classic “bailout” of the variety that the government used to rescue global insurance giant AIG.²⁹⁸ Lastly, the government can simply roll the dice, let a systemically important firm fail, and face the consequences. This was the option that the government fatefully chose in response to the imminent failure of Lehman Brothers in September 2008.²⁹⁹

The consensus view among commentators has long been that the failure of a major clearinghouse or depository would have catastrophic consequences for financial stability.³⁰⁰ Reflecting this consensus, the Financial Stability Oversight

294. *Evaluation of Too-Big-to-Fail Reforms: Summary Terms of Reference*, FIN. STABILITY BD. 1 (May 23, 2019), <https://www.fsb.org/wp-content/uploads/P230519.pdf> [<https://perma.cc/L3UG-X84Q>].

295. *See id.*

296. *See* THE FIN. CRISIS INQUIRY COMM’N, THE FINANCIAL CRISIS INQUIRY REPORT: FINAL REPORT OF THE NATIONAL COMMISSION ON THE CAUSES OF THE FINANCIAL AND ECONOMIC CRISIS IN THE UNITED STATES 343, 434 (2011).

297. *See* Anthony J. Casey & Eric A. Posner, *A Framework for Bailout Regulation*, 91 NOTRE DAME L. REV. 479, 481 (2015).

298. *See* CONG. OVERSIGHT PANEL, JUNE OVERSIGHT REPORT: THE AIG RESCUE, ITS IMPACT ON MARKETS, AND THE GOVERNMENT’S EXIT STRATEGY 2 (June 10, 2010).

299. *See* James B. Stewart & Peter Eavis, *Revisiting the Lehman Brothers Bailout that Never Was*, N.Y. TIMES (Sept. 29, 2014), <https://www.nytimes.com/2014/09/30/business/revisiting-the-lehman-brothers-bailout-that-never-was.html> [<https://perma.cc/AK48-Q2CP>].

300. *See, e.g.*, Bernanke, *supra* note 27, at 2.

Council designated both NSCC and DTC as systemically important financial-market utilities in 2012.³⁰¹ NSCC and DTC would likely have been systemically important even if they were not monopolists. But their size, interconnectedness, and especially their status as the only institutions providing clearing and depository services to U.S. equity, fixed-income, and other markets mean that their failure would in all likelihood unleash chaos within global financial markets.

Were NSCC or DTC to find themselves on the verge of failure, their dominant market position would further constrain the government's already limited options. Because NSCC and DTC are monopolists in U.S. clearing and depository markets, they cannot be strategically sold to a competitor.³⁰² For the same reason, and especially given the importance of clearing and settlement to the smooth and efficient functioning of the financial system, it is simply not credible to expect the government to allow either of these firms to fail. Thus, if one or both of these institutions reach the brink of collapse, a government bailout would be both the most effective and likeliest option.³⁰³

Any future government bailout of NSCC or DTC would be costly. It would reinforce the expectation that the government would not let other systemically important firms fail, thus driving these firms to take socially excessive risks.³⁰⁴ More broadly, taking these firms into public ownership would be politically fraught and might deter private industry from entering the markets for clearing and settlement services. Ultimately, by pricing regional clearinghouses and depositories out of business, open-access and interoperability requirements have made it more difficult and costlier for the government to support these vital financial-market infrastructures. In this way, SEC-mandated coordination requirements may have inadvertently exacerbated the too-big-to-fail problem.

301. See *Designations*, U.S. DEP'T TREASURY, <https://home.treasury.gov/policy-issues/financial-markets-financial-institutions-and-fiscal-service/fsoc/designations> [https://perma.cc/B3QL-JCA7].

302. It is theoretically possible, but not certain, that firms that clear other financial products, such as the Options Clearing Corporation, the Chicago Mercantile Exchange, or the Intercontinental Exchange, could take over NSCC's operations.

303. If one of these firms failed, the government would be forced to choose between bankruptcy, bailout, or a government-managed liquidation (known as the Orderly Liquidation Authority (OLA)). One can argue that the OLA is a form of bailout, since the U.S. Treasury Department can provide indirect support to a failing firm's creditors. In addition, Congress has proposed complementing the OLA by creating a Chapter 14 of the Bankruptcy Code to help recapitalize systemically important financial institutions. See Ryan Rossner, *Senate Judiciary Committee Hearing on Bankruptcy for Banks and Proposed Chapter 14*, HARV. L. SCH. BANKR. ROUNDTABLE (Dec. 4, 2018), <http://blogs.harvard.edu/bankruptcyroundtable/2018/12/04/senate-judiciary-committee-hearing-on-bankruptcy-for-banks-and-proposed-chapter-14> [https://perma.cc/AZT2-G57V].

304. For a discussion of bailouts, see generally Casey & Posner, *supra* note 297.

Interoperability is thus something of a double-edged sword. On the one hand, while interoperability can spread contagion and prevent firms from capturing economies of scale that might help them manage systemic risks, it also ensures at least some substitutability, together with other firms that might absorb the business of failed competitors. In theory, the existence of these competitors serves to reduce the likelihood that the failure of a single firm would lead to market disruption and breakdown and, thus, to costly and controversial government bailouts. On the other hand, where interoperability leads to monopoly, the result will be that a few large firms provide essential products and services. While economies of scale may better position these firms to manage systemic risks, their size, interconnectedness, and limited substitutability will make them too big to fail. Accordingly, where interoperability requirements lead to industry consolidation and monopoly, government ownership will be the only credible option in a crisis.

B. Interoperability as a Remedy in Antitrust

DTCC's path to monopoly also has important implications for competition law. In theory, open-access and interoperability requirements are designed to facilitate the creation of common infrastructure, thereby enabling industries to take advantage of scale economies and network effects without giving a single firm a monopoly. By dividing the costs of building and maintaining this infrastructure among market participants, open access and interoperability are also designed to reduce barriers to entry. In doing so, these requirements eliminate the need for new entrants to make significant and potentially redundant infrastructure investments, which in turn promotes greater competition.

So why did the SEC's open-access and interoperability requirements not only fail to promote competition but ultimately become one of the instruments by which DTCC obtained its monopoly? Our story suggests that there are at least three intertwined reasons. First, to successfully promote greater competition, interoperability requires the high fixed costs of building and maintaining common infrastructure to be allocated in a way that does not itself generate anticompetitive effects. Indeed, this is precisely why the SEC imposed most of the costs associated with the *development* of electronic clearing and depository interfaces on NSCC and DTC.³⁰⁵ Yet, in hindsight, the SEC neglected to consider another important source of costs: the need for market participants to *connect* to, *maintain*, and ensure *ongoing compatibility* with these interfaces.

305. See *supra* Section II.C.

The regional clearinghouses and depositories still had to construct their own technological, operational, and human-resource infrastructure to provide electronic clearing and depository services. Regional clearinghouses had to develop automated systems to clear and settle financial transactions. Regional depositories, meanwhile, had to develop expensive systems to record and update ownership information electronically. And both regional clearinghouses and depositories needed to employ the management, information-technology, and back-office personnel necessary to keep these systems up and running. Further, the regional clearinghouses and depositories had to make additional investments in systems for communicating with NSCC, DTC, and their regional rivals so that they could clear trades between brokers that were members of different exchanges. These investments were significant, ongoing, and largely duplicated across NSCC, DTC, and regional clearinghouses and depositories.³⁰⁶

These costs elucidate the conditions under which coordination requirements are likely to be effective. Specifically, if the costs of building, connecting, and updating common infrastructure cannot be equitably allocated among market participants, then the ongoing demands of interoperability may ultimately have anticompetitive effects. Facing high fixed costs, smaller firms may struggle to make the investments necessary to connect to common infrastructure and, thereafter, ensure ongoing compatibility with this infrastructure as it inevitably evolves. Where these costs are not readily divisible or where the allocation mechanism does not account for these potential distortions, interoperability might contribute to industry consolidation.

The second reason the SEC's coordination requirements—particularly the requirement to build interoperable interfaces—failed to forestall monopoly control is that they allowed NSCC and DTC to dictate the direction and pace of infrastructure innovation and investment. Because they were the largest and most sophisticated players in the market, it is not surprising that NSCC and DTC were often at the forefront of technological and operational improvements to the U.S. securities clearing and depository systems. Yet, whenever NSCC and DTC introduced a new product or service, the effect of the SEC's interoperability requirements was to force their smaller and less sophisticated rivals either to adopt the same improvements or to exit the marketplace. For example, when NSCC and DTC invested in cutting-edge computer systems to facilitate T+3 securities and same-day funds settlement, interoperability demanded that the remaining regional players make significant investments in new technology capable of facilitating these faster settlement times. Understandably, rather than making these enormous and essentially redundant investments, each regional

306. See *supra* Section II.C.

player eventually sold or surrendered their clearing and depository businesses to NSCC and DTC.³⁰⁷

The fact that NSCC and DTC had significant influence over the rollout of any improvements to the securities clearing and depository infrastructures – and, thus, the nature, timing, and size of their competitors’ investments – yields two important takeaways about the governance of interoperable networks. First, as described above, unless the fixed costs of updating common infrastructure are allocated in a way that is sensitive to differences in firm size, otherwise valuable and efficiency-enhancing improvements can still generate competitive distortions. Second, where these distortions cannot be eliminated, regulators should consider the use of collaborative-governance arrangements designed to ensure that dominant firms cannot unilaterally drive the direction and pace of network innovation and investment.

In this crucial respect, the designers of future interoperability requirements might draw lessons from another vital component of our financial-market infrastructure: Visa.³⁰⁸ Before converting into a publicly traded corporation in 2008, Visa was a not-for-profit entity that licensed its core technological infrastructure and network access to member banks.³⁰⁹ This licensing arrangement had two key features. First, license fees were based on network *usage*: larger banks, which were generating higher transaction volumes, paid a larger share of fees than their smaller rivals.³¹⁰ Simultaneously, any fees generated in excess of Visa’s operating costs were automatically reinvested into the network. Second, reflecting this differential economic treatment, Visa’s governance structure allocated voting rights to members on the basis of transaction volumes. At the same time, however, the firm’s board of directors was deliberately “designed to balance the interests and power of all the members, regardless of size and location.”³¹¹

This arrangement yielded several benefits. First, because Visa’s license fees were based on transaction volumes, larger banks paid a higher proportion of its operating costs and investments in network improvements. While the result was effectively a subsidy in favor of smaller banks, this fee structure also helped neutralize the competitive distortions generated by the massive economies of scale

307. *See supra* Section II.C.

308. For a detailed history of Visa Inc. and its predecessors, see generally PAUL CHUTKOW, *VISA: THE POWER OF AN IDEA* (2001).

309. *See* DAVID L. STERNS, *ELECTRONIC VALUE EXCHANGE: ORIGINS OF THE VISA ELECTRONIC PAYMENT SYSTEM* 46–49, 200 (2011).

310. *See id.* at 48.

311. *Id.* at 49.

within the credit-card market.³¹² Second, by organizing as a not-for-profit entity and retaining excess-fee revenue, Visa could pool capital to invest in new technology. Among other network improvements, these investments ultimately contributed to the development of VisaNet (Visa's global payment-processing platform) and the widespread adoption of magnetic-stripe, chip-and-pin, and other payment-card technologies.³¹³ Third, the one-share, one-vote governance model prevented larger banks from dictating major decisions, including decisions about the nature, direction, and pace of new infrastructure investments. Lastly, the scope of this arrangement was limited to Visa's core network infrastructure.³¹⁴ This gave member banks ample room to compete along other dimensions, including interest rates, reward programs, and other card features. While these specific arrangements are perhaps unique to Visa's circumstances, this example demonstrates how thoughtful cost allocation and governance structures can promote the coordinated development of interoperable networks that capture economies of scale and counter momentum toward monopoly.

The third and final reason why the SEC's coordination requirements failed to prevent monopoly control is that open access and interoperability stymied market participants from competing. Here, interoperability morphed into a form of highly standardized outsourcing. This might have occurred because of high infrastructure costs or poorly designed interfaces. Either way, when regional clearinghouses and depositories developed interfaces with NSCC and DTC, they often used the infrastructure NSCC and DTC had already developed to clear and settle most trades.³¹⁵ This eliminated the regional firms' ability to compete with NSCC and DTC because their only path to profitability was to layer additional processes – and costs – on top of those already built by NSCC and DTC. Ultimately, for open access and interoperability to offer an alternative to monopoly, they must leave some room for firms to distinguish their products and services from those of their competitors.

Notably, this product differentiation is relatively straightforward when open access and interoperability operate *vertically* across two or more markets. For ex-

312. Following the elimination of restrictions on interstate banking and the resulting emergence of national retail-banking giants such as Citigroup, Bank of America, and JPMorgan Chase, this subsidy became a source of significant tension, ultimately contributing to the decision to convert Visa into a for-profit, publicly traded corporation. *See id.* at 50.

313. *See id.* at 132, 149.

314. *See id.* at 47, 112.

315. *See supra* Section II.C.

ample, gas-pipeline owners are required to allow shippers to bid for pipeline capacity.³¹⁶ Bidders that submit qualifying rates are entitled to use the pipeline.³¹⁷ Accordingly, while open access and interoperability in gas markets prevent discrimination against shippers, they do not prevent gas producers and pipeline companies from competing with each other. A producer that offers a competitive rate receives access to the pipeline. Similarly, a firm that can construct a less expensive or more durable pipeline than its competitors can offer a superior product and will therefore capture market share and potentially increase profit margins. Thus, when open access and interoperability are designed to prevent a firm from using its market power to gain an advantage in a related market, it seems plausible that they will ensure that the firm does not wield its market power to tip the scales in favor of its own products.

More significant challenges can arise when open access and interoperability operate *horizontally* within a market. By their very nature, the firms subject to horizontal open-access and interoperability requirements will compete to provide substitutable products and services. This competition is not necessarily

316. See Regulation of Natural Gas Pipelines After Partial Wellhead Decontrol, 50 Fed. Reg. 42408, 42408 (Oct. 9, 1985) (ordering open access in gas pipelines); Pipeline Service Obligations and Revisions to Regulations Governing Self-Implementing Transportation; and Regulation of Natural Gas Pipelines After Wellhead Decontrol, 57 Fed. Reg. 13267, 13267 (Apr. 8, 1992) [hereinafter FERC Order No. 636] (regulating pipelines as open-access transporters); FERC Order No. 636, *supra*, at 13269 (explaining that one goal of regulating pipelines as open-access transporters “is to ensure that all shippers have meaningful access to the pipeline transportation grid so that willing buyers and sellers can meet in a competitive, national market to transact the most efficient deals possible”). Although the Federal Energy Regulatory Commission has made significant revisions to Order No. 636, the agency continues to enforce open-access and interoperability requirements in gas markets. See Order Denying Rehearing in Part, Granting Rehearing in Part, and Clarifying Order No. 636, 57 Fed. Reg. 36128 (Aug. 3, 1992); Order Denying Rehearing and Clarifying Order Nos. 636 and 636-A, 57 Fed. Reg. 57911 (Nov. 27, 1992); Pipeline Service Obligations and Revisions to Regulations Governing Self-Implementing Transportation Under Part 284 and Regulation of Natural Gas Pipelines After Partial Wellhead Decontrol, 62 Fed. Reg. 10204 (Feb. 27, 1997).

317. See FERC Order No. 636, 57 Fed. Reg. at 13270 (“[T]his rule requires pipelines to unbundle (*i.e.*, separate) their sales services from their transportation services at an upstream point near the production area and to provide all transportation services on a basis that is equal in quality for all gas supplies whether purchased from the pipeline or from any other gas supplier. This rule issues blanket sales certificates to pipelines so that they can offer unbundled firm and interruptible sales services at market-based rates. In addition, pipelines will be required to provide a variety of transportation services to their shippers. This includes a new unbundled ‘no-notice’ firm transportation service, firm transportation service that is unbundled and improved in quality, unbundled storage services, and interruptible transportation services, among others [T]his will permit gas purchasers and gas sellers to choose the exact transportation service that they want, including a combination of services that will ensure that the pipelines can deliver an adequate supply of gas to the city gate from various sources when that supply is needed.”).

problematic so long as firms still have sufficient scope to differentiate their products and services. Consider, for instance, the success of the intermodal transportation industry in using interoperability to realize scale economies without undermining competition. Today, most of the world's shipping containers have the same physical dimensions.³¹⁸ This enables shippers to take full advantage of available cargo space while promoting competition in the market for shipping containers. Crucially, a key to this success is that interoperability does not prevent container manufacturers from differentiating their products in ways other than the height, width, and depth of the box itself. Specifically, firms can still compete on features such as price, weight, security, and durability. The same is true of the electricity market, where firms are required to build transmission lines that provide the same voltage but have the scope to develop cheaper and more durable lines.³¹⁹

Nevertheless, problems start to arise where one or more firms in a horizontally interoperable market provide critical *intermediate* components of their competitors' products.³²⁰ The resulting vertical supply relationships will be especially problematic where these intermediate components dictate the core features driving demand within the horizontal market for the final product and the suppliers of these intermediate products also use them in their own final products.³²¹ Where this is the case, not only will suppliers potentially enjoy significant market power over their competitors' cost structure, but the use of the same critical intermediate components across the entire industry will likely foreclose meaningful product differentiation, choice, and, ultimately, competition.

Viewed in this light, the fact that SEC-mandated interoperability envisioned that the regional clearinghouses and depositories would rely heavily on the information-technology, operational, and other post-trade infrastructure developed by NSCC and DTC is extremely important. This reliance meant that the clearing, settlement, and depository services provided by NSCC, DTC, and their regional competitors were practically identical from the perspective of their customers. Accordingly, even if we think it would have been unrealistic for the regional players to compete with NSCC and DTC on the basis of the speed or

318. See *General Purpose Containers*, *supra* note 92.

319. See Ari Peskoe, *Is the Utility Transmission Syndicate Forever?*, 42 ENERGY L.J. 1, 8, 14 (2021).

320. An "intermediate" component, good, or product is one that is used to create a final product. See *What Is an Intermediate Good?*, CORP. FIN. INST., <https://corporatefinanceinstitute.com/resources/knowledge/economics/intermediate-good> [https://perma.cc/4DMF-Z3GF]. Thus, for example, flour is an intermediate product in the creation of bread.

321. As an aside, this combination of *vertical* supply relationships in the context of *horizontal* competition demonstrates the artificiality of the distinction between "vertical" and "horizontal" in some markets.

overall service quality, legally mandated interoperability also effectively prevented them from launching a slower, lower-quality service designed to compete with NSCC and DTC on the basis of price. In a market where these smaller firms were prevented from competing on both quality and price, it is little wonder they eventually chose to exit.

These conclusions have potential implications far beyond the financial-services industry. In particular, there is growing concern among policymakers that large tech companies restrict access to their platforms in ways designed to cement their market power. Against this backdrop, policymakers have advanced open-access and interoperability requirements as potentially useful tools to address these concerns. For example, the European Union has recently proposed regulations that would require tech firms to make their apps interoperable with horizontal and vertical competitors.³²² These rules would require Apple's iMessage and Meta's WhatsApp, which currently have closed ecosystems, to become interoperable with other messaging apps.³²³ In the United States, similar concerns recently prompted a bipartisan group of Senators to introduce legislation that would prohibit tech firms from giving their own products preferential treatment.³²⁴ Here, too, open access and interoperability are central to the proposed legislation.³²⁵

It is difficult to articulate detailed recommendations for translating our conclusions from the world of financial-market infrastructure to the world of Big Tech. The size and shape of the relevant networks, the costs of network development and upgrades, the dynamics of market competition, and the implications of network failure are too different to accommodate straightforward comparisons. Nonetheless, in terms of checking anticompetitive behavior, DTCC's path to monopoly offers a cautionary tale for reformers who would use open access and interoperability to regulate the tech industry.

This cautionary tale holds out three lessons. First, in addition to allocating the initial fixed costs of building interoperable infrastructure, policymakers must also pay attention to the ongoing costs of connecting to and updating this infrastructure and ensure that the allocation of these costs among network users does

322. See Ben Brody, *Europe's Plan to Rein in Big Tech Will Require Apple to Open Up iMessage*, PROTOCOL (Mar. 24, 2022), <https://www.protocol.com/bulletins/europe-dma-apple-imessage> [<https://perma.cc/R8G8-5TFQ>].

323. See *id.*

324. See Press Release, John Kennedy, Sen., U.S. Senate, Kennedy, Klobuchar, Grassley Introduce American Innovation and Choice Online Act to Rein in Big Tech (Oct. 18, 2021), <https://www.kennedy.senate.gov/public/2021/10/kennedy-klobuchar-grassley-introduce-american-innovation-and-choice-online-act-to-rein-in-big-tech> [<https://perma.cc/2MQZ-GPUP>].

325. See *id.*

not generate competitive distortions. Theoretically, this can be achieved in a variety of ways, from volume-based pricing to joint ownership of the infrastructure itself. Second, decisions about future investments in the improvement of this common infrastructure should not be left to individual firms. Instead, policymakers should design and implement collaborative-governance structures that deny larger firms the ability to dictate the nature, timing, or size of the infrastructure investments made by their smaller rivals. Finally, in designing interoperable networks, policymakers must make space for competition between a network's users. Ultimately, where implementing these lessons is not possible, open-access and interoperability requirements are unlikely to achieve the desired policy objectives.

C. Benefits of Open Access and Interoperability

Our analysis does not suggest that open-access and interoperability requirements will always generate anticompetitive effects. While these requirements exacerbated NSCC and DTC's market power, they have offered a viable alternative to monopoly in other markets.³²⁶ The history of securities depositories and clearinghouses, therefore, does not suggest that open-access and interoperability requirements have no place in the arsenal of conventional antitrust remedies. It rather suggests that where open access and interoperability do not eliminate redundant infrastructure investments or where they impede the ability of firms to distinguish themselves from their competitors, these requirements, often touted as an alternative to monopoly control, may, in fact, be a means to that same anticompetitive end.

Yet, even where they fail to prevent firms from securing a monopoly, well-designed open-access and interoperability requirements can still have important salutary effects. First, when there is uncertainty about whether a particular market is a natural monopoly, open-access and interoperability requirements might serve as a means by which to determine the existence and size of economies of scale. In effect, by compelling firms to coordinate in the development of common infrastructure, policymakers can avoid dictating the market structure *ex ante* and instead allow the market to determine over time the most efficient level of industry concentration. While this demands that policymakers identify and, ideally, eliminate any distortive effects of coordination requirements, well-designed open-access and interoperability requirements may thus reveal valuable information about the optimal structure of a given market.

Second, open-access and interoperability requirements can discipline monopolists by leaving the door open to new entrants. For example, even after

326. *See supra* Section I.C.

NSCC and DTC obtained their monopolies, the threat of new entry continued to constrain their monopolist impulses. This was most evident in the mid-2000s, when NSCC and DTC reduced their prices in response to Nasdaq's attempt to build its own clearinghouse.³²⁷ At the time, Nasdaq argued that it would be able to take market share from NSCC by offering cheaper products and services.³²⁸ Importantly, had Nasdaq succeeded, the existence of open-access and interoperability requirements would have given it immediate access to the entire market and, with it, the ability to compete directly with NSCC and DTC. In reducing their clearing and depository fees, NSCC and DTC responded to the credible threat of new competition. The mere existence of these requirements thus continues to exert competitive pressure on NSCC and DTC.

Finally, the existence of the SEC's open-access and interoperability requirements means that, if future technological advances undercut the status of securities clearing and depository markets as natural monopolies, new entrants will be in a relatively strong position to challenge NSCC and DTC. Indeed, while it may have been prohibitively expensive for regional players to invest in the technological infrastructure necessary to build state-of-the-art clearinghouses and depositories in the 1980s and 1990s, falling technology costs mean that this soon may no longer be the case. In a similar vein, distributed-ledger technology may one day offer an alternative to centralized clearinghouses and depositories³²⁹—although significant questions remain about the feasibility and cost of ensuring that these ledgers are compatible with existing financial-market infrastructure.³³⁰ The point is that the existence of open-access and interoperability requirements ensures that new entrants will be able to demand nondiscriminatory

327. See *supra* notes 286–287 and accompanying text.

328. See *Nasdaq Plans to Compete with the NSCC*, *supra* note 286.

329. See Randy Priem, *Distributed Ledger Technology for Securities Clearing and Settlement: Benefits, Risks, and Regulatory Implications*, 6 FIN. INNOVATION art. no. 11, at 7 (2020).

330. Among other questions, it is not clear how technologists' visions of "real time" (and therefore *gross*) securities clearing and settlement via distributed-ledger technology (DLT) could be made compatible with the existing deferred *net* clearing and settlement systems. Ultimately, unless NSCC and DTC voluntarily decide to adopt DLT, and thus open themselves up to potential new competition, it is difficult to envision how these rival technological platforms could compete horizontally within securities clearing and depository markets, given the existence of SEC-mandated interoperability. In theory, the use of DLT as a substitute for the current depository system is more promising. See Charles W. Mooney, Jr., *Beyond Intermediation: A New (Fintech) Model for Securities Holding Infrastructures*, 22 U. PA. J. BUS. L. 386, 390–92 (2020). In practice, however, given the economies of scope between securities clearing, settlement, and depository services, the technical challenges of ensuring the interoperability of real-time gross clearing and settlement systems and deferred net clearing and settlement systems would potentially serve as an additional barrier to the emergence of depository systems based on DLT.

access to the existing infrastructure, thereby reducing barriers to new entry and promoting greater competition. At the very least, these requirements force incumbents to remain vigilant to the threat of technological disruption and keep pace with technological developments.

CONCLUSION

The revitalized antimonopoly movement has advanced open-access and interoperability requirements as a potential solution to problems of market power. Yet, not only did the SEC's open-access and interoperability requirements ultimately fail to prevent NSCC and DTC from securing their dominant market positions, but they actually helped pave DTCC's path to monopoly. The history of the regional clearinghouses and depositories thus offers an illuminating case study and, in many respects, a cautionary tale. There is little doubt that open access and interoperability can be useful policy tools. But, to ensure that these requirements do not exacerbate the market power of Big Tech, finance, and energy companies, policymakers should consider whether they compel firms to make duplicative infrastructure investments, whether they enable dominant players to dictate the direction, timing, and size of their rivals' investments in new innovation, and whether they leave room for firms to differentiate their products and services from those of their competitors. Where they do not, open access and interoperability are unlikely to forestall monopoly control. More importantly, they may become the tools that dominant firms use to obtain and entrench their monopoly power.