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

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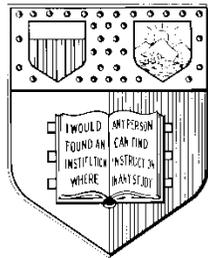
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Open Access, Interoperability, and DTCC's Unexpected Path to Monopoly

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

Dan Awrey & Joshua Macey***

Abstract. In markets with significant scale economies and network effects, scholars and policymakers often tout open access and interoperability requirements as superior to both regulated monopoly and the break-up of dominant firms. In theory, by compelling firms to coordinate to develop common infrastructure, regulators can use these requirements to replicate scale and network economies without leaving markets vulnerable to monopoly power. Examples of successful coordination include the provision of electricity, intermodal transportation, and credit card networks.

This Article analyzes the history of U.S. securities clearinghouses and depositories in order to offer a significant qualification to this received wisdom. This history demonstrates that open access and interoperability requirements can actually 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 actually exacerbate the very problems that they were designed to address.

Our analysis helps 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 have still been characterized by relatively high levels of innovation and investment. More broadly, our analysis suggests that coordination requirements will only constrain market power where the costs of building, maintaining, and connecting to common infrastructure are allocated in a way that does not discriminate against smaller firms, and where larger firms are not able to dictate decisions about innovation and investment. Where this is not possible, interoperability and open access are unlikely to forestall monopoly control, even though they may 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 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 traditional concerns about economic efficiency, these scholars contend that large concentrations of economic power exacerbate income inequality, undermine the free expression of ideas, and pose a threat to the democratic political process.³ Echoing this broad view of antimonopoly, a 2020 Report published as part of the House Investigation on Competition in Digital Markets

¹ The term “antimonopoly” is broader than “antitrust” and refers to a menu of 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); K. SABEEL RAHMAN, *DEMOCRACY AGAINST DOMINATION* (2016).

² See TIM WU, *THE CURSE OF BIGNESS: ANTITRUST IN THE NEW GILDED AGE* (2018); Lina M. Khan, *The End of Antitrust Revisited*, 133 HARV. L. REV. 1655 (2020).

³ See Lina Khan & Sandeep Vaheesan, *Market Power and Inequality: The Antitrust Counterrevolution and Its Discontents*, 11 HARV. L. & POL’Y REV. 235 (2017); Sanjukta Paul, *Antitrust as Allocation of Coordination Rights*, 67 UCLA L. REV. 378 (2020).

concluded that the largest tech firms “wield their dominance in ways that erode entrepreneurship, degrade Americans’ online privacy, 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 control the entire market.⁵ In fact, at different points over the past century, scholars and policymakers have argued that a variety of industries should be viewed as natural monopolies and thus best served by a single firm.⁶ Today, these arguments are echoed by those who believe that the biggest tech firms 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

These industries’ scale benefits create unique regulatory challenges. As a preliminary matter, the drive to capture scale can lead firms to compete not just *in* the market, but *for* the market.⁹ In the process, firms may make investments that turn out to be duplicative once a single firm secures monopoly control.¹⁰ Once a monopoly has been secured, the winner may then take advantage of its dominant market position by engaging in abusive pricing practices or other anticompetitive conduct. At the same time, monopoly control might discourage innovation,¹¹ and, according to some, large concentrations of economic power can destabilize the democratic process.¹² And last (but not least), depending on the products and services that a monopolist supplies, dominant firms may become systemically important: forcing governments to bail them out during periods of financial distress. This is the so-called “too-big-to-fail” problem that received widespread attention in the wake of the 2008 financial crisis.¹³

⁴ See Majority Staff Report and Recommendations, Subc. On Antitrust, Investigation of Competition in Digital Markets 6-7 (2020).

⁵ See Part 1.II for a more detailed description of economies of scale, scope, and network effects, along with their relationship with (natural) monopolies.

⁶ See ALFRED KAHN, *THE ECONOMICS OF REGULATION* 11 (1988) (explaining that many regulated monopolies have governed industries that are “natural monopolies” whose “costs will be lower if they consist in a single supplier”).

⁷ K. Sabeel Rahman, Testimony Before the US House of Representative Subcommittee on Antitrust 2 (Oct. 1, 2020), <https://docs.house.gov/meetings/JU/JU05/20201001/111072/HHRG-116-JU05-Wstate-RahmanS-20201001.pdf>.

⁸ *Id.*

⁹ Michael Kades & Fiona Scott Morton, *Interoperability as a Competition Remedy for Digital Networks*, Wash. Ctr. For Equitable Growth 1 (Sept. 2020), <https://equitablegrowth.org/working-papers/interoperability-as-a-competition-remedy-for-digital-networks/> (“[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 greater because the market tends to be winner-take-all, or most.”).

¹⁰ *See id.*

¹¹ See Michael Riordan, *No Monopoly on Innovation*, HARV. BUS. REV. (Dec. 2005) (“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.”).

¹² See House Digital Markets Report, *supra* note ____.

¹³ See Ben S. Bernanke, *Ending Too Big To Fail: What’s the Right Approach?*, BROOKINGS (May 13, 2016), <https://www.brookings.edu/blog/ben-bernanke/2016/05/13/ending-too-big-to-fail-whats-the-right-approach/>.

Proponents of more robust antitrust enforcement have long recognized the limits of traditional antitrust remedies in industries characterized by significant economies of scale. These traditional remedies range from fines for abusive conduct, to rate regulation coupled with strict government oversight, to the break-up of dominant firms. Instead, scholars and policymakers have advocated for the use of regulatory strategies that seek to compel market participants to *coordinate* with each other to develop and maintain socially useful market infrastructure.¹⁴ Commonly used coordination mechanisms include *interoperability* and *open access* requirements. Interoperability requirements compel firms to work together to develop products and services that are compatible with those offered by their competitors. A species of interoperability requirements—interconnection requirements—also compel firms to build, maintain, and connect to common infrastructure through which their goods and services are provided. Open access requirements, meanwhile, ensure that firms that exercise control over this infrastructure make it available to new entrants on competitive terms.¹⁵

Together, open access and interoperability requirements are designed to mitigate market power abuses and ameliorate the too-big-to-fail problem.¹⁶ In theory, they also allow firms to capture the benefits of scale without granting a single firm a monopoly over an entire industry.¹⁷ 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.¹⁸

Recognizing the potential benefits of these coordination requirements,¹⁹ an energized antimonopoly movement has urged regulators to use open access and

¹⁴ Kades & Scott Morton, *supra* note ___, at 1. *See* Telecommunications Act of 1996, Pub L No 104-104, 110 Stat 56 (1996), §§ 251-52, as codified at 47 USC §§ 251–52 (2002) (requiring incumbent local telephone carriers to lease parts of their telephone networks to potential rivals); Herbert Hovenkamp, *Antitrust and Platform Monopoly*, 130 YALE L.J. 1952, 1957 (2021) (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 and Randal C. Picker, *Entry Policy in Local Telecommunications Iowa Utilities and Verizon*, S. CT. REV. 1, 1 (2003) (“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.”). *Cf.* Randal C. Picker, *Regulating Network Industries: A Look at Intel*, 23 HARV. J. L. & PUB. POLY 159 (1999) (considering when central oversight improves efficiency in network industries).

¹⁵ *See, e.g.* SEC Release 17806, 42 Fed. Reg. 44053 (Sept. 1, 1977) (ordering NSCC to “offer to operate each interface and link under agreements which would provide that the parties to the interface or link 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* Promoting Wholesale Competition Through Open Access Non-Discriminatory Transmission Services by Public Utilities, Order No. 888, 61 Fed. Reg. 21,540 (May 10, 1996) (imposing open-access and coordination requirements).

¹⁶ *See* House Digital Markets Report, *supra* note ___, at 20 (proposing “[i]nteroperability and data portability [that] require[e] dominant platforms to make their services compatible with various networks and to make content and information easily portable between them”).

¹⁷ *See id.* 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.”).

¹⁸ *See* Kahn, *supra* note ___, at 11.

¹⁹ *See* Kades & Scott Morton, *supra* note ___, 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

interoperability to force competing firms to coordinate in the development and maintenance of common infrastructure.²⁰ What is more, regulators seem increasingly sympathetic to this view. 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.²¹ 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.”²² Beyond Silicon Valley, scholars have argued that policymakers should adopt a similar stance toward the regulation of internet service providers, financial institutions, and energy companies.²³ Should this movement gain momentum, we may thus find ourselves riding the crest of a new wave of public utility regulation.

Given this renewed interest in public utility regulation, it is important to better understand the design, governance, and limits of the coordination 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 under-studied,²⁴ institutions at the heart of our financial market infrastructure: securities clearinghouses and depositories. Securities clearinghouses

entry, maximizing the potential for new entrants to enter at minimal cost, compete in the market, and take share from the incumbent.”).

²⁰ See William Boyd, *Public Utility and the Low-Carbon Future*, 61 UCLA L. REV. 1614 (2014); William Boyd, *Just Price, Public Utility, and the Long History of Economic Regulation in America*, 35 YALE J. REG. 721 (2018); K. Sabeel Rahman, *Infrastructural Regulation and the New Utilities*, 35 YALE J. REG. 911 (2018); K. Sabeel Rahman, *The New Utilities: Private Power, Social Infrastructure, and the Revival of the Public Utility Concept*, 39 CARDOZO L. REV. 1621 (2018); Lina M. Khan, *The Separation of Platforms and Commerce*, 119 COLUM. L. REV. 937 (2019) (arguing that the “combined problems of discrimination and information appropriation invite recovering common carriage’s forgotten cousin: structural separations”); Lina M. Khan, *Amazon’s Antitrust Paradox*, 127 YALE L.J. 710, 797 (2017) (suggesting that one approach to regulating tech platforms “is to accept dominant online platforms as natural monopolies or oligopolies, seeking to regulate their power instead”); William Novak, *The Public Utility Idea and the Origins of Modern Business Regulation*, in THE CORPORATION AND AMERICAN DEMOCRACY (Naomi R. Lamoreux & William J. Novak eds., 2017); William J. Novak, *Law and the Social Control of American Capitalism*, 60 EMORY L.J. 377 (2010). Nondiscrimination is often described as a third coordination requirement. 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 2, though they do not appear to have been as controversial as open access or interoperability.

²¹ See *United States v. Google*, Complaint for Injunctive and Equitable Relief para. 4-9 (D. D.C. Oct. 20, 2020), <https://www.justice.gov/opa/press-release/file/1328941/download>.

²² See Fed. Trade Comm’n v. Facebook, Complaint for Injunctive and Equitable Relief para. 22 (D. D.C. Dec. 8, 2020), <https://www.ftc.gov/system/files/documents/cases/1910134fbcomplaint.pdf> [emphasis added].

²³ See *id.*; Randal Picker, *Pursuing a Remedy in Microsoft: The Declining Need for Centralized Coordination in a Networked World*, 158 J. INST. & THEOR. ECON. (2001) 113, 114 (arguing the technological advances have reduced the need for centralized coordination).

²⁴ 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 (mandatory) clearing mandates. See, e.g. Felix B. Chang, *The Systemic Risk Paradox: Banks and Clearinghouses Under Regulation*, 3 COLUM. BUS. L. REV. 747 (2014); Felix B. Chang, *Financial Market Bottlenecks and the Openness Mandate*, 23 GEO. MAS. L. REV. 69 (2015); Yuliya Guseva, *Destructive Collectivism: Dodd-Frank Coordination and Clearinghouses*, 37 CARDOZO L. REV. 1693 (2016); Mark Roe, *Clearinghouse Overconfidence*, 101 CAL. L. REV. 1641 (2013); Jeremy Kress, *Credit Default Swaps, Clearinghouses, and Systemic Risk: Why Centralized Counterparties Must Have Access to Central Bank Liquidity*, 48 HARV. J. LEG. 49 (2011); Richard Squire, *Clearinghouses as Liquidity Partitioning*, 99 CORNELL L. REV. 857 (2016); Paolo Saguato, *The Ownership of Clearinghouses: When Skin in the Game Is Not Enough*, 34 YALE J. REG. 601 (2017); Paolo Saguato, *The Unfinished Business of Regulating Clearinghouses*, COLUM. BUS. L. REV. (2021) (forthcoming); David Wishnick, *Reengineering Financial Market Infrastructure*, 105 MINN. L. REV. (2021) (forthcoming).

and depositories are the “plumbing” of the financial system.²⁵ Clearinghouses record securities trading data, verify trade details, and coordinate the transfer of securities to buyers and funds to sellers.²⁶ Many clearinghouses also act as financial guarantors, standing between the two sides of a trade.²⁷ Securities depositories play a complementary role, holding securities on behalf of their owners and maintaining and updating records of their legal and beneficial ownership.²⁸

Securities clearinghouses and depositories are essential to the smooth, efficient, and resilient operation of modern financial markets.²⁹ Indeed, it is no exaggeration to say that they 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.³⁰ These concerns recently reached a fevered pitch after longstanding rules imposed by the dominant securities clearinghouse temporarily forced the popular online trading platform Robinhood to suspend new buy orders in GameStop and several other popular “meme” stocks.³¹ The aftermath has sparked public outcry, congressional hearings, and even calls for an SEC investigation.³² It also revealed the enormous 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. Fifty years ago, American securities markets were supported by a number of regional clearinghouses and depositories, each connected to a regional stock exchange.³³ Today, a single firm—the National Securities Clearing Corporation (NSCC)—is the only remaining clearinghouse,³⁴ while another—the Depository Trust Corporation

²⁵ See Ben S. Bernanke, Chairman, Bd. of Governors, Fed. Reserve Sys., Remarks at the 2011 Financial Markets Conference 1 (Apr. 4, 2011), <http://www.federalreserve.gov/newsevents/speech/bernanke20110404a.pdf>; Armour et al., *Principles of Financial Regulation* (2016), chapter 18.

²⁶ See CPMI, *A Glossary of Key Terms Used in Payment and Settlement Systems* (2016), <https://www.bis.org/cpmi/publ/d00b.htm>.

²⁷ See *id.*

²⁸ See *id.*

²⁹ See Ben S. Bernanke, Clearinghouses, Financial Stability, and Financial Reform, Speech at the 2011 Financial Markets Conference (Apr. 11, 2011), <https://www.bis.org/review/r110405b.pdf>.

³⁰ See Roe, *Clearinghouse Overconfidence*, *supra* note __, at 1644-45 (2013); Chang, *supra* note __; Ben S. Bernanke, Remarks at 2011 Financial Markets Conference, Clearinghouses, Financial Stability, and Financial Reform (Apr. 4, 2011), <https://www.federalreserve.gov/newsevents/speech/bernanke20110404a.htm>.

³¹ See Matt Levine, *Money Stuff: Robinhood Had a Busy Week*, BLOOMBERG OPINION (Feb. 2, 2021), <https://www.bloomberg.com/opinion/articles/2021-02-02/gamestop-trade-was-a-mixed-bag-for-robinhood>. See also Written Testimony of Michael C. Bodson, Chief Executive Officer of DTCC, before the U.S. House Committee on Financial Services (May 6, 2021), <https://financialservices.house.gov/uploadedfiles/hhr-117-ba00-wstate-bodsonm-20210506.pdf>.

³² See John Harney, *House Financial Services Panel Sets GameStop Hearing for February 18*, BLOOMBERG (Feb. 1, 2021), <https://www.bloomberg.com/news/articles/2021-02-02/house-financial-services-panel-sets-gamestop-hearing-for-feb-18>; Benjamin Bain, *SEC Hunts for Fraud in Social-Media Posts Hyping GameStop*, BLOOMBERG (FEB. 2, 2021), <https://www.bloomberg.com/news/articles/2021-02-03/sec-hunts-for-fraud-in-social-media-posts-that-drove-up-gamestop>.

³³ See *infra* Part 2.II.

³⁴ See *id.*

(DTC)—is the only remaining depository.³⁵ Even more remarkably, both NSCC and DTC are owned by the same parent company: DTCC.

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 be grounded in the economies of scale and network effects associated with securities clearing and settlement.³⁶ 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 originally designed to enhance competition with the U.S. securities clearing and depository markets.³⁷ These amendments prohibited the Securities and Exchange Commission (SEC) from granting NSCC and DTC monopolies over their respective industries. Instead, Congress ordered the SEC “to facilitate the establishment of linked or coordinated facilities for clearance and settlement of transactions in securities.”³⁸ 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.”³⁹ Put simply: Congress and the SEC sought to use open access and interoperability requirements to promote more vigorous competition.⁴⁰

Yet less than thirty years later, NSCC and DTC were the last firms standing.⁴¹ Rather than promoting greater competition, the SEC’s open access and interoperability requirements became an instrument by which large incumbent firms obtained, consolidated, and entrenched their dominant market positions. This concentration occurred for three reasons. First, these coordination requirements did not eliminate the need for each regional clearinghouse and depository to build and maintain the technological and operational linkages that allowed them to *connect* to the new SEC-mandated market infrastructure. The high fixed costs of building these linkages placed a disproportionate burden on smaller firms, putting them at a competitive disadvantage.

³⁵ *See id.*

³⁶ While there are multiple clearinghouses in the United States, each controls virtually the entire market for the financial product it clears. *See* U.S. Dep’t of Treas., *Designation of Systemically Important Financial Market Utilities*, <https://home.treasury.gov/system/files/261/here.pdf> (listing the each systemically important financial market utility’s market share); *See also* Chang, *The Systemic Risk Paradox*, *supra* note __, at 764 (“NSCC has been compared to a public utility, a common solution for natural monopoly.”); *Bradford Nat’l Clearing Corp. v. SEC*, 590 F.2d 1085, 1101 (D.C. Cir. 1978); *In the Matter of the Application of the National Securities Clearing Corporation for Registration as a Clearing Agency*, Securities Exchange Act Release No. 13163, n.198, 11 SEC Docket 1448, 1483 (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.”).

³⁷ 15 U.S.C. § 78q-1(a) (2) (listing “competition among . . . clearing agencies” as one of the amendment’s principal goals).

³⁸ *See* 15 U.S.C. § 78q-1(a)(2)(A)(ii).

³⁹ *See* 17 C.F.R. 240.17Ab2-1(c).

⁴⁰ 15 U.S.C. § 78q-1(a) (2); 17 C.F.R. 240.17Ab2-1(b).

⁴¹ *See* Press Release, DTCC Finally Puts DTC and NSCC onto a Single Platform (Jan. 14, 2004), <https://www.globalcustodian.com/dtcc-finally-puts-dtc-and-nbcc-on-to-a-single-platform-after-six-months-of-dual-running/> (“Through DTC and NSCC, DTCC provides clearance and settlement services for virtually all trades done on the New York Stock Exchange, Nasdaq and the American Stock Exchange, as well as on all regional exchanges and electronic communications networks (ECNs) in the United States.”).

Second, the SEC's coordination requirements enabled larger firms like NSCC and DTC to dictate the direction and pace of their rivals' technological innovation.⁴² Whenever NSCC and DTC introduced technological improvements to their clearing and depository systems, the SEC's coordination requirements forced their regional competitors to make enormous infrastructure investments to ensure the technological compatibility of their own products and services.⁴³ This, in turn, contributed to market consolidation, since whenever NSCC and DTC adopted new products and services, they forced the regional firms to do so as well—and to bear the substantial costs of building better, faster, and more resilient clearing and depository systems. To avoid those costs, the smaller regional firms eventually ceded their clearing and depository businesses to NSCC and DTC.

Lastly, coordination requirements prevented firms from differentiating their products and services from those of their competitors. Open access and interoperability quickly morphed into a form of outsourcing that resulted in firms offering virtually identical products and services. Specifically, because the interoperable interfaces mandated by the SEC made it possible for brokerage firms 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.⁴⁴ In practice, this meant that the regional clearinghouses and depositories had no choice but to rely on NSCC and DTC.⁴⁵ Ultimately, this undercut the ability of these smaller 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.

The SEC's open access and interoperability requirements were not the only driver behind the consolidation of the U.S. securities clearing and depository industries. 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 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.⁴⁶ Nevertheless, the consolidation of the U.S. securities clearing and depository industries and the rise of the DTCC—against the backdrop of the SEC's

⁴² Randy Picker has made a similar point in his analysis of scope of permission goods and copyright. See Randal C. Picker, *Unbundling Scope of Permission Goods: When Should We Invest in Reducing Entry Barriers*, 72 U. CHI. L. REV. 189 (2005); Randal C. Picker, *Copyright as Entry Policy: The Case of Distribution*, ANTITRUST BULLETIN (2002).

⁴³ See *infra* Part 2.II.

⁴⁴ See *id.*

⁴⁵ This may 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, what they really did was use the infrastructure NSCC and DTC had constructed to execute most trades.

⁴⁶ For a discussion of these other developments, see e.g. Merritt Fox, Lawrence Glosten & Gabriel Rauterberg, *THE NEW STOCK MARKET: LAW, ECONOMICS OF POLICY* 13-19 (2019) (describing the evolution of securities trading); Reena Aggarwal, *Demutualization and The Corporate Governance of Stock Exchanges*, 15:1 J. OF APPLIED CORP. FIN. 105 (2005) (describing the evolving ownership structure and governance of exchanges); Maureen O'Hara & Alfredo Mendiola, *Taking Stock in Stock Markets: The Changing Governance of Exchanges*, Working Paper (2002) [on file with authors]; Norman Poser, *Restructuring the Stock Markets: A Critical Look at the SEC's National Market System*, 56 N.Y.U. L. REV. 883 (1981) (describing and evaluating the early development of the National Market System), and Gregg Jarrell, *Change at the Exchange: The Cause and Effects of Deregulation*, 27:2 J. L. & ECON. 273 (1984) (describing and evaluating the elimination of fixed brokerage commissions).

open access and interoperability requirements—represents an important and previously untold chapter within this broader story.

This chapter has significant implications beyond the narrow and hyper-technical world of financial market infrastructure. The first is for financial regulation. As a threshold matter, our analysis helps 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 would have likely been systemically important regardless of the prevailing level of industry consolidation.⁴⁷ Crucially, however, 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. Viewed in this light, our more fundamental insight is that the SEC's open access and interoperability requirements have contributed to a lack of substitutability, thus leaving regulators with few options other than public ownership or a taxpayer-funded bailout should NSCC and DTC ever find themselves on the brink of failure.⁴⁸

The second 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 redistribution of the otherwise high and potentially duplicative costs of developing and maintaining infrastructure among multiple competing firms. However, our analysis suggests that where these costs are not readily divisible, not 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 interoperability is often touted as an alternative to both regulated monopoly and the break-up of dominant firms, the reality is that legally mandated interoperability can have significant anticompetitive effects. Mitigating these effects requires careful thought about not only the *allocation* of the costs of building, maintaining, and connecting to common infrastructure, but also about the *governance* of decisions about the direction, timing, and size of new infrastructure investments.

This is not to suggest that open access and interoperability requirements will always have anticompetitive effects. While in the case of U.S. securities clearing and depository markets they served to concentrate market power in the hands of NSCC and DTC, in other markets they have offered a viable alternative to monopoly. Rather, our analysis suggests that where the costs of building a platform, network, or other infrastructure cannot be effectively allocated across multiple firms, the use of coordination requirements as an alternative to monopoly control may in fact exacerbate the very problems they were designed to address. Ultimately, of course, 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

⁴⁷ Clearinghouses and depositories provide vital infrastructure and, as the Financial Stability Oversight Council (FSOC) acknowledged in designating these firms as systemically important financial market utilities, their failure would be catastrophic. See Report to the President of the United States, Financial Stability Oversight Council Designations (Nov. 17, 2017), <https://www.treasury.gov/press-center/press-releases/Documents/PM-FSOC-Designations-Memo-11-17.pdf>. 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 NORTHWESTERN L. REV. 872 (2020).

⁴⁸ See Part 3.II.

anticompetitive effects of open access and interoperability can be harmful. It is that the tradeoff between scale economies and market power is sometimes unavoidable.

In this vein, our analysis also suggests a qualified defense of open access and interoperability requirements even where they fail to forestall monopoly control. Specifically, where there is uncertainty about whether a particular market is a natural monopoly, interoperability may offer a means of determining the optimal market structure. By compelling securities clearinghouses and depositories to coordinate with each other, policymakers were able to avoid dictating the optimal market structure by regulatory fiat and instead allow the market to determine, over time, whether securities clearing and depository markets should be controlled by a single firm. Moreover, while interoperability failed to prevent NSCC and DTC from obtaining a monopoly, it left clearing and depository markets vulnerable to new entry. This, in turn, has continued to spur investment and innovation and reduce—although not eliminate—monopoly rents.

This Article proceeds in three Parts. Part 1 describes the conventional view that open access and interoperability requirements can replicate economies of scale without handing over control of an entire industry to a single firm. Part 2 traces the history of the U.S. securities clearing and depository industries, describes the SEC's open access and interoperability requirements, and chronicles NSCC and DTC's slow and steady march towards monopoly. Part 3 considers the potential policy implications for both financial regulation and the use of coordination requirements as an alternative to traditional antitrust remedies.

1. COORDINATION, NOT CONSOLIDATION

Natural monopolies require policymakers to thread a difficult needle. On one hand, in markets characterized by significant economies of scale, scope, or network effects, industry fragmentation leads to higher costs. In many cases, these higher costs suggest that the market would be best served by a single firm.⁴⁹ On the other hand, once a single firm comes to monopolize the market, 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, along with the range of regulatory responses that policymakers have conventionally used to address these challenges.

I. The Problems of Monopoly

Scholars have long warned of the economic and political challenges that arise when a monopolist controls an entire industry.⁵⁰ The first is that monopolists have both the

⁴⁹ As Richard 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 Posner, *Natural Monopoly and Its Regulation*, 21 STAN. L. REV. 548, 548 (1969).

⁵⁰ Adam Smith offered an early, and eloquent critique when he wrote that: “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

incentive and the ability to raise prices and restrict supply. The issue is not simply that monopolists will increase the price of goods and services, but that monopoly leads to an inefficient 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.⁵¹

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 exclusionary conduct that stifles competition and innovation by other firms.⁵² There are several possible reasons why monopolists may lack incentives to innovate. According to one theory, developed by Ken Arrow, innovation generates fewer rewards when output is restricted.⁵³ If it is costly to develop a new technology, a rational monopolist that restricts output will only be able to spread—or amortize—those costs across the reduced units of production.⁵⁴ Arrow also observed that an incumbent has weaker incentives to innovate than a new entrant when the new product overlaps with its existing portfolio of products.⁵⁵ In effect, while competitors are induced by the prospect of capturing rivals' market share, monopolists may be concerned that an innovative new product would cannibalize demand for the firm's existing products.

Of course, it is not always the case that market concentration reduces an incumbent firm's incentives to innovate.⁵⁶ Innovations that lower costs can increase incumbent profit margins, and many successful incumbents have made substantial investments in new technologies.⁵⁷ Famous examples include Verizon's decision to build a 5G wireless network, Intel's repeated innovations in micro-processing chip technology, Boeing's ongoing development of a fleet of commercial aircraft, and numerous pharmaceutical discoveries.⁵⁸ Notably, however, in each of these cases, it is the *threat* of competition that encourages monopolists to invest in new products.⁵⁹ In contrast, firms that are completely shielded from

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 publick 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." ADAM SMITH, *THE WEALTH OF NATIONS* 438 (2019).

⁵¹ 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.

⁵² See generally Jeffrey A. Rosen, Deputy Atty Gen., U.S. Dep't of Justice, Speech at the Free State Foundation's Annual Telecom Policy Conference (Mar. 10, 2020), <https://www.justice.gov/opa/speech/deputy-attorney-general-jeffreyrosen-speaks-free-state-foundations-12th-annual-telecom>; Giulio Federico, Fiona Scott Morton & Carl Shapiro, Antitrust and Innovation: Welcoming and Protecting Disruption 1 (Nat'l Bureau of Econ. Res. Working Paper No. 26005, June 2019), <https://www.nber.org/papers/w26005.pdf>. There is considerable debate about this question. See Harold Demsetz, *Industry Structure, Market Rivalry, and Public Policy*, 16 JOURNAL OF LAW AND ECONOMICS 1, 3 (1973); Richard Gilbert & David Newbery, *Preemptive Patenting and the Persistence of Monopoly*, 72 AMERICAN ECONOMIC REVIEW 514, 516 (1982).

⁵³ See Kenneth Arrow, *Economic Welfare and the Allocation of Resources to Invention*, in *THE RATE AND DIRECTION OF INVENTIVE ACTIVITY: ECONOMIC AND SOCIAL FACTORS* 609, 615-19 (1962).

⁵⁴ See *id.*

⁵⁵ See *id.*; Thomas J. Holmes, David K. Levine, & James H. Schmitz, *Monopoly and the Incentive To Innovate When Adoption Involves Switchover Disruptions*, 4 AM. ECON. J.: MICROECONOMICS 1, 2 (2012).

⁵⁶ See *id.*

⁵⁷ See Federico, Scott Morton, & Shapiro, *supra* note ____.

⁵⁸ See *id.*

⁵⁹ See *id.* at 2 ("[I]nnovation is best promoted when market leaders are allowed to exploit their competitive

competition, such as electric utilities that enjoy a legal right to a monopoly, have historically made virtually no investments in research and development and have long resisted innovation.⁶⁰

More broadly, in all markets, incumbents have an incentive to use anticompetitive rather than procompetitive strategies to acquire, build, and protect their market share.⁶¹ For example, incumbents often acquire potential competitors for the sole purpose of heading off competition. These so-called “killer acquisitions” involve the strategic purchase of upstart firms in order to discontinue the competitor’s operations: preventing these nascent competitors from bringing their products to market and, thus, protecting the incumbent firm’s market share.⁶²

The third problem is that monopolies and monopoly power can contribute to the emergence and amplification of a firm’s systemic importance. The resulting too-big-to-fail problem 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 bail them out rather than risk their failure destabilizing the financial system and broader economy.⁶³

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. Specifically, the expectation of a government bailout undermines the incentives of the firm’s creditors to monitor its capital structure, business decisions, and overall financial health. The resulting lack of oversight then gives the managers of the firm free rein to take socially excessive risks.⁶⁴ Compounding matters, this expectation will often serve to lower the cost of financing for too-big-to-fail firms.⁶⁵ 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. Viewed in this light, the too-big-to-fail problem is yet another source of competitive distortions: giving too-big-to-

advantages while also facing pressure to perform coming from both conventional rivals and from disruptive entrants.”).

⁶⁰ See Marilyn Waite, *Why US Utilities Should Invest in Innovation*, Utility Dive (Apr. 24, 2017), <https://www.utilitydive.com/news/why-us-utilities-should-invest-in-innovation/441114> (“The research and development (R&D) budgets of U.S. electric utilities—both POU’s and IOU’s—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%.”)

⁶¹ The Sherman Act prohibits such conduct. See 15 U.S.C. § 2 (2018).

⁶² Colleen Cunningham, Florian Ederer & Song Ma, *Killer Acquisitions*, J. POL. ECON. 3, 19 (2020) (describing the practice of “acquir[ing] innovative targets solely to discontinue the target’s innovative projects and preempt future competition.”). One might think, however, 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 Raghuram Rajan, Sai Krishna Kamepalli & Luigi Zingales, *Kill Zone* (Becker Friedman Institute Working Paper No. 2020-19), <https://ssrn.com/abstract=35559> (estimating that between 5.3 and 7.4 percent of pharmaceutical acquisitions are killer acquisitions). 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 *id.*

⁶³ See Ben S. Bernanke, Chairman, Bd. of Governors of the Fed. Res. Sys., Statement Before the Financial Crisis Inquiry Commission 20 (Sept. 2, 2010), <http://www.federalreserve.gov/newsevents/testimony/bernanke20100902a.pdf>.

⁶⁴ See *id.*

⁶⁵ See Mark Roe, *Structural Corporate Degradation Due to Too-Big-To-Fail Finance*, 162 U. PA. L. REV. 1419, 1422 (2014) (“The likelihood that big finance will be bailed out in a crisis lowers the financial firms’ cost of funding. These lower financing costs redound to the benefit of the firms’ shareholders.”).

fail firms access to an important resource—capital—at a lower price than their smaller competitors. This, in turn, exacerbates their systemic importance by enabling already dominant firms to further increase their market share.⁶⁶

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 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.⁶⁷ Lastly, when an industry is systemically important, the existence of a monopoly will also increase the likelihood that the government will need to bail out a failing firm, thereby generating further competitive distortions.

II. The Impact of Scale Economies and Network Effects

Market power poses regulatory challenges whenever a firm enjoys a monopoly. However, the appropriate regulatory response is generally understood to depend on whether the particular market is characterized by significant economies of scale. Scale economies exist when the average unit costs of producing a product or service *decrease* as production *increases*.⁶⁸ Scale economies can also be 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.⁶⁹ Consider social media networks. The users of Facebook, Twitter, or Instagram are more likely to use these networks if their friends do—in effect because they will be able to connect with more users on a single platform. Importantly, this also makes these users less likely to switch to new networks if they do not know a critical mass of friends who use a competitor's platform.⁷⁰ Viewed from this perspective, both economies of scale and network effects give larger firms a comparative advantage over their smaller rivals. These advantages intersect with the concept of a natural monopoly: the larger the scale and network effects, the higher the costs of industry fragmentation, and the more likely it will be efficient for a single firm to control the entire market.⁷¹

Natural monopolies often exist in industries with high fixed costs. Some goods or services, such as cable lines, electric transmission infrastructure, and gas pipelines, require large upfront investments.⁷² While it is initially very expensive to build the infrastructure

⁶⁶ *See id.*

⁶⁷ Raising prices simply redistributes value from buyers to sellers. That may be objectionable on distributive grounds, but it is not inefficient. *See* WILLIAM W. SHARKEY, *THE THEORY OF NATURAL MONOPOLY* 2 (2009)

⁶⁸ *See id.* *See* ROBERT FRANK, BEN BERNANKE, KATE ANTONOVICS, & ORI HEFFETZ, *PRINCIPLES OF ECONOMICS* 32-33 (2019).

⁶⁹ *See* Paul Klemperer, *Network Goods (Theory)*, in 5 *THE NEW PALGRAVE DICTIONARY OF ECONOMICS* 915, 915 (Steven N. Durlauf & Lawrence E. Blume eds., 2nd ed. 2008).

⁷⁰ Michael L. Katz & Carl Shapiro, *Systems Competition and Network Effects*, 8 *J. ECON. PERSP.* 93, 108 (1994).

⁷¹ Natural monopolies refer to markets in which there are cost advantages associated with size. They are generally characterized by declining average costs. *See id.* Economists refer to this condition as subadditivity, which describes a market where costs are lower when one firm controls all production. *See* Ronald R. Braeutigam, *Optimal Policies for Natural Monopolies*, in 2 *HANDBOOK OF INDUSTRIAL ORGANIZATION* 1289, 1294-96 (Richard Schmalensee & Robert D. Willig eds., 1989).

⁷² *See* Chang, *Bottlenecks* *supra* note ___, 82.

necessary to enter these markets, it is relatively inexpensive to provide an additional marginal unit of the good or services once the infrastructure is in place. Competitors, by contrast, would be required to make the massive infrastructure investment needed to build this infrastructure from the ground up.⁷³

These industries pose unique challenges for regulators. Perhaps most importantly, policymakers face potentially significant tradeoffs when attempting to apply traditional antitrust remedies. For example, while breaking up dominant firms may mitigate market power abuses, applying this remedy in the context of a natural monopoly would also prevent firms from taking advantage of scale economies and network effects. Other antitrust remedies are also of limited use in this context. While fining a firm for engaging in a “conspiracy” to obtain a monopoly position may work in some contexts, this remedy will be wholly ineffective where a firm’s dominant position can be attributed to lower production costs rather than corporate skullduggery. Moreover, fines will not effectively deter future anticompetitive behavior where the firm can simply pass the associated costs onto consumers—which is more likely when a firm exercises monopoly power.⁷⁴

In industries characterized by pronounced economies of scale and network effects, regulators thus face pressure to permit high levels of industry concentration. Yet doing so almost inevitably leaves these industries vulnerable to all the problems generally associated with monopoly power. To avoid making a Hobson’s choice between regulated monopoly and enforced break-up, regulators have instead often turned to coordination requirements such as open access and interoperability.

III. Alternatives to Break Up

In markets characterized by significant economies of scale or network effects, policymakers have historically eschewed the break-up of dominant firms in favor of their strict regulation.⁷⁵ One common regulatory strategy is rate regulation, whereby a regulator closely manages the price and quality of the goods and services that dominant firms provide.⁷⁶ 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 competitive market.⁷⁷ Considerable scholarly attention has been paid to the rationale, design, and impact of rate regulation in various industries.⁷⁸ This

⁷³ See Lazard, *Levelized Cost of Energy and Storage* (2020), <https://www.lazard.com/perspective/levelized-cost-of-energy-and-levelized-cost-of-storage-2020/>.

⁷⁴ See Bernanke *supra* note __, at 52.

⁷⁵ Scholars, policymakers, and judges have also articulated a variety of reasons for eschewing break-ups that are ostensibly unrelated to economies of scale and network effects; see Rory Van Loo, *In Defense of Breakups: Administering A Radical Remedy*, CORNELL L. REV. [forthcoming] (describing the skepticism about breakups amongst antitrust scholars, judges, and regulators).

⁷⁶ See KAHN *supra* note __, at 4-7.

⁷⁷ Another option that has received significant attention in recent years is to require “structural separations”—to prohibit platforms from operating in certain related markets.

⁷⁸ See, e.g. See Harvey Averch & Leland L. Johnson, *Behavior of the Firm Under Regulatory Constraint*, 52 AM. ECON. REV. 1052 (1962). For important economic work building on their theory, see William J. Baumol & Alvin K. Klevorick, *Input Choices and Rate-of-Return Regulation: An Overview of the Discussion*, 3 BELL J. ECON. & MGMT. SCI. 162 (1970); Alvin K. Klevorick, *The Behavior of the Firm Subject to Stochastic Regulatory Review*, 4 BELL J. ECON. & MGMT. SCI. 57 (1974).

Article, however, focuses on two other regulatory strategies that policymakers have frequently relied on to mitigate market power abuses in these industries: open access and interoperability requirements.⁷⁹

The concepts of open access and interoperability have considerable overlap but are analytically distinct. Interoperability describes strategies whereby firms—either voluntarily or pursuant to a legal mandate—coordinate in the development of common infrastructure or to ensure the compatibility of substitutable or complementary goods and services. The international standards for shipping containers are illustrative.⁸⁰ Today, most shipping containers, regardless of their origin or manufacturer, are designed so that they are the same shape and size and can be easily stacked one on top of another. This common design increases the efficiency with which containers can be loaded into 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.⁸¹

A species of interoperability requirements—*interconnection* requirements—compel firms to build, maintain, and connect to common infrastructure through which their goods and services are provided. The Interstate Commerce Act, for example, requires common railroad carriers to “construct, maintain, and operate” switches connecting their tracks to those of other railroads.⁸² 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. 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 non-discriminatory access to existing platforms and other infrastructure. A recent example of the use of this strategy is the Federal Communication Commission’s (FCC) now-repealed net neutrality rules. These rules, which prohibited internet service providers (ISPs) from providing preferential treatment to some users, were designed to create an open access regime for the internet.⁸³

While interoperability and open access often go hand in hand, it is possible for a firm, network, or industry to provide open access but not interoperability (and vice versa).

⁷⁹ Note that rate regulation, coordination requirements, and open-access requirements are not substitutes but can be used in combination. *See* Promoting Wholesale Competition Through Open Access Non-Discriminatory Transmission Services by Public Utilities, Order No. 888, 61 Fed. Reg. 21,540 (May 10, 1996) (imposing open-access and coordination requirements). A third concept, nondiscrimination, is a close cousin of open access. *See id.* (imposing nondiscrimination requirements on transmission providers).

⁸⁰ *See* What Is Intermodal Transportation? (Jul. 18, 2017), <https://www.shipag.com/blog/2017/07/what-intermodal-transportation-and-when-it-best-choice/>.

⁸¹ *See id.*

⁸² *See* Hepburn Act, Pub. L. 59-337, 34 Stat. 584, para. 9(1) (Jun. 29, 1906).

⁸³ Protecting and Promoting the Open Internet, 30 F.C.C. Rcd. 5601, 5603, para. 4 (2015) (“[C]arefully-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.”).

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.⁸⁴ Similarly, a group of tech companies could agree to integrate their operating systems while simultaneously excluding or disfavoring their common rivals.⁸⁵ In this case, while the tech companies will have pursued a strategy of interoperability, they will not have ensured open access.

Policymakers have long used interoperability and open access requirements to replicate scale economies and network effects. In the 1880s, Congress established the Interstate Commerce Commission to ensure that railroads provided nondiscriminatory service to customers.⁸⁶ In 1982, the Department of Justice entered into a consent decree with AT&T in which the Bell System agreed to provide its competitors, which had themselves been spun out of AT&T, with access to its long-distance telephone network.⁸⁷ In 1996, the Federal Energy Regulatory Commission (FERC) ordered transmission utilities to provide generators with open access to the distribution system that transports electric power from producers to consumers.⁸⁸ And in 2015, the FCC promulgated its Open Internet Order, which can be understood as an open access requirement for ISPs.⁸⁹ A similar approach was echoed by the House Judiciary Committee in its 2020 Report on Competition in Digital Marketplaces, which embraced interoperability and open access requirements as a regulatory strategy for mitigating the growing market power of the largest tech firms.⁹⁰

The idea behind each of these regulations is that coordination requirements can enable an industry to capture the benefits generated by economies of scale and network effects while also mitigating the problems created by monopoly power. But as the next Part shows, there are important and underappreciated exceptions to this conventional wisdom.

2. THE HISTORY OF NSCC AND DTC

Our image of American securities markets is dominated by Wall Street: of its once 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—

⁸⁴ See Promoting Wholesale Competition Through Open Access Non-Discriminatory Transmission Services by Public Utilities, Order No. 888, 61 Fed. Reg. 21,540 (May 10, 1996) (imposing open-access and coordination requirements).

⁸⁵ See Daisuke Wakabayashi & Jack Nicas, *Apple, Google and the Deal that Controls the Internet*, NYTIMES (Oct. 25, 2020), <https://www.nytimes.com/2020/10/25/technology/apple-google-search-antitrust.html>.

⁸⁶ See Interstate Commerce Act, Public Law 49-41, 49 U.S.C. §§ 3-22 (Feb. 4, 1887).

⁸⁷ See *United States v. AT&T*, 552 F. Supp. 131 (D.D.C.1982). Its competitors, known as Baby Bells, largely consisted of companies that were spun off of the Bell System in response to the consent decree.

⁸⁸ See Promoting Wholesale Competition Through Open Access Non-Discriminatory Transmission Services by Public Utilities, Order No. 888, 61 Fed. Reg. 21,540 (May 10, 1996) (requiring transmission line owners to file “open access tariffs”).

⁸⁹ Protecting and Promoting the Open Internet, 30 FCC Rcd. 5601, 5603, para. 4 (2015) (“[C]arefully-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.”); Barbara van Schewick, *Network Neutrality and Quality of Service: What a Nondiscrimination Rule Should Look Like*, 67 STAN. L. REV. 1, 4 (2015).

⁹⁰ See House Digital Markets Report, *supra* note ___, 19-20.

at 55 Water Street. This is the home of the Depository Trust and Clearing Corporation (DTCC) and its twin subsidiaries, the National Securities Clearing Corporation (NSCC) and Depository Trust Company (DTC).⁹¹ 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 history of securities clearinghouses and depositories in the United States to show how the SEC's interoperability and open access requirements were one of the instruments by which NSCC and DTC obtained their current monopolies.

I. Overview of Depositories and Clearinghouses

Securities clearinghouses and depositories are part of the vast and complex plumbing of the financial system.⁹² Once a trade is executed on the NYSE, Nasdaq, or other trading platforms, the details of the transaction—including the identify of parties and the type, quantity, and price of the security—are sent to a clearinghouse.⁹³ 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*). As part of this process, clearinghouses may also identify and net out—i.e. cancel—any offsetting obligations owed between the two parties. A specialized subset of clearinghouses, known as central counterparties (or CCPs⁹⁴), also stand between the buyer and seller, guaranteeing the performance of each party's obligations. If, for whatever reason, one party is unable to honor its commitments, CCPs will step into the shoes of the party and perform its contractual obligations.⁹⁵ In this way, CCPs 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 \$1 *trillion* worth of equity securities per day.⁹⁶

Depositories, meanwhile, perform a variety of complementary functions. Most importantly, depositories keep records of the legal and beneficial owners of securities. They

⁹¹ Although, for operational reasons, many of DTCC's core functions are now performed from its offices across the Hudson River in Jersey City, New Jersey.

⁹² For excellent analyses of other aspects of financial plumbing, see Morgan Ricks, *Money as Infrastructure*, 2018 COLUM. BUS. L. REV. 757; Morgan Ricks, *Safety First? The Deceptive Allure of Full Reserve Banking*, U CHI. L. REV. ONLINE (2016); John Crawford, Lev Menand, & Morgan Ricks, *FedAccounts: Digital Dollars*, 89 GEO. WASH. L. REV. 113 (2020); Peter Conti-Brown & David Wishnick, *Private Markets, Public Options, and the Payment System*, 37 YALE J. REG. 380 (2020).

⁹³ For the purposes of the Securities Exchange Act, these clearinghouses fall into the category of "clearing agencies"; 15 U.S.C. 78c(a)(23)(A) ("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.").

⁹⁴ See Bank of International Settlements, *A Glossary of Terms Used in Payments and Settlements* (Mar. 2003), https://www.bis.org/cpmi/glossary_030301.pdf.

⁹⁵ See *id.*

⁹⁶ DTCC Annual Report (Dec. 31, 2019), <https://www.dtcc.com/annuals/2019/financial-performance>.

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. Today, however, depositories memorialize the ownership and transfer of securities electronically, moving money and “disintermediated” securities between customer accounts held with the depository.⁹⁷ 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.⁹⁸ Today DTC is the sole depository for all equity, corporate, and municipal debt instruments traded in the United States.⁹⁹ As of November 2020, DTC provides custodial service for securities worth an estimated \$37.2 trillion and processes approximately 1.4 million transactions per day with a value of approximately \$600 billion.¹⁰⁰

The first American clearinghouse was established in New York in 1853.¹⁰¹ In little over a decade, clearinghouses had also sprung up in other major commercial centers: including Boston (1856), Philadelphia (1858), Baltimore (1858), and Chicago (1865).¹⁰² By the end of the century, hundreds of regional and local clearinghouses “dotted the American banking landscape.”¹⁰³ These early clearinghouses were mostly owned by banks, who used them to clear and settle checks and other negotiable instruments issued by other banks.¹⁰⁴

Prior to the advent of these clearinghouses, banks typically cleared and settled checks using informal networks of correspondent relationships.¹⁰⁵ 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 of two banks, typically junior clerks or couriers, would meet on a periodic basis 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 them the money they owed even though the positions canceled each other out entirely.

Clearinghouses replaced this system with a multilateral clearing and settlement process. Rather than periodically calculating and settling their 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

⁹⁷ *See id.*

⁹⁸ *See id.*

⁹⁹ *See* What is DTC?, <https://www.dtcc.com/settlement-and-asset-services/issuer-services/how-issuers-work-with-dtc>.

¹⁰⁰ *See id.*

¹⁰¹ *See* William A. Camp, *The New York Clearinghouse*, 154 N. AM. REV. 684, 685 (1882). The first clearinghouse was likely established in London in 1773. *See id.* at 684.

¹⁰² *Id.* at 5.

¹⁰³ *Id.*

¹⁰⁴ *See* Gary Gorton, *Private Clearinghouses and the Origins of Central Banking*, THE BUSINESS REVIEW 3, 3-4 (Jan./Feb. 1984); Charles W. Calomiris & Gary Gorton, *The Origins of Banking Panics*, in FINANCIAL MARKETS AND FINANCIAL CRISES (1991).

¹⁰⁵ *See* Gorton, *Private Clearinghouses*, *supra* note ___, 4.

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. By settling payments on a multilateral basis, clearinghouses thus centralized the payment process. This reduced the total number and size of payments, along with the exposure of both the clearinghouse and each member bank to the default of other banks in the network.

A second advantage of clearinghouses was that, by reducing the number and size of interbank payments, they also greatly reduced the need for banks to keep large amounts of cash on hand for the purposes of settling their bilateral payment obligations.¹⁰⁶ 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.¹⁰⁷ 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.¹⁰⁸ Between 1800 and 1915, twelve bank panics roiled the American financial system and broader economy.¹⁰⁹ Depositors, concerned about possible bank failures, rushed to withdraw their deposits.¹¹⁰ 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.¹¹¹

Clearinghouses provided a solution to this liquidity problem.¹¹² Facing an incipient panic, banks would submit bonds and other investments to the clearinghouse as collateral.¹¹³ In exchange, the clearinghouse would issue certificates that banks could then use to satisfy their outstanding obligations within the clearing network, thereby freeing up much need cash for the purpose of honoring their commitments to depositors and other creditors. In some cases, the certificates even found their way into public circulation.¹¹⁴ Member banks were willing to accept these certificates not only because they were backed by collateral, but also, and crucially, because they represented the *joint* obligations of other member banks.¹¹⁵ Where a member bank defaulted and the posted collateral was insufficient to cover its outstanding

¹⁰⁶ *See id.*

¹⁰⁷ These certificates were themselves typically backed by gold deposited by one member bank with another designated member bank; *id.*, 4-5.

¹⁰⁸ *See* Richard Timberlake, Jr., *The Central Banking Role of Clearinghouse Associations*, 16 J. MONEY BANKING & CREDIT 1, 2 (1984); Gorton, *Private Clearinghouses*, *supra* note ____.

¹⁰⁹ *See id.*

¹¹⁰ *See id.*

¹¹¹ *See id.*

¹¹² *See id.*

¹¹³ *See id.*

¹¹⁴ Initially, these loan certificates were only issued in large denominations and circulated exclusively amongst 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; Gorton, *Private Clearinghouses*, *supra* note ____, 282.

¹¹⁵ *See id.*

obligations, surviving members would thus be required to cover the residual losses in proportion to their capital in the clearinghouse.¹¹⁶

This innovation—the clearinghouse—would eventually spread from banking to securities markets. The New York Stock Exchange took its initial, and rather limited, foray into securities clearing in 1892.¹¹⁷ This was followed by the creation of the Stock Clearing Corporation in 1920.¹¹⁸ But it was not until the dramatic spike in securities trading volumes in the late 1960s that the importance of this new financial market infrastructure became clear.

II. 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 physically change hands every time a trade was completed.¹¹⁹ Compounding matters, the brokerage firms that processed these trades relied on thirty-three different documents, including a floor report, transfer instructions, various contract sheets, and settlement instructions to execute each and every trade.¹²⁰ This cumbersome process barely held together during the early 1960s, when equity trading volumes rarely exceeded three million shares per day. By the end of the decade, however, average daily equity trading volumes had reached 13 million shares a day—with the NYSE experiencing several days on which 20-30 million shares changed hands.¹²¹ Like banks a hundred years earlier, brokerage firms were forced to employ hundreds of messengers to run around Lower Manhattan to physically settle transactions.¹²² This 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.”¹²³ 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.¹²⁴ Firms regularly lost track of the physical securities in their possession.¹²⁵ The resulting settlement failures

¹¹⁶ While defaulting banks were typically not permitted to fail during a panic, they were often expelled from the clearinghouse once the panic subsided. The threat of expulsion was thus viewed as a powerful enforcement mechanism. See Gorton, *Private Clearinghouses*, supra note __, 279.

¹¹⁷ See Bernanke supra note __, 3.

¹¹⁸ See New York Stock Exchange (1930), *Report of the President: May 1st, 1929–May 1st, 1930* (New York: NYSE), at 66-68.

¹¹⁹ See Larry E. Bergman, Sr. Assoc. Director, Division of Market Regulation, U.S. Securities and Exchange Comm’n, *The U.S. View of the Role of Regulation in Market Efficiency* (Feb. 10, 2004), <https://www.sec.gov/news/speech/spch021004leb.htm>.

¹²⁰ See *id.*

¹²¹ SEC, *Study of Unsafe And Unsound Practices of Brokers and Dealers*, H.R. Doc. No. 231, 92d Cong., 1st Sess. 14-15, 13 (1971) [hereinafter SEC Study].

¹²² Bergman, supra note __.

¹²³ SEC Study, supra note __, 34.

¹²⁴ See *id.*

¹²⁵ See *id.*

led to at least \$4 billion in losses during the late 1960s alone.¹²⁶ As firms struggled to keep up with the increasing volume of trades, market participants became concerned that financial institutions would be unable to monitor their holdings and manage their security positions.¹²⁷

In a report on the Paperwork Crisis, the SEC explained that “an archaic method of achieving this simple objective [transferring securities] nearly drowned the financial community in a tidal wave of uncontrolled paper.”¹²⁸ 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 1969-1970 period than the improvement and modernization of the systems for clearing, settlement, delivery, and transfer of securities.”¹²⁹

NSCC 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 of loss, theft and error arising from outdated procedures.”¹³⁰ 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 Clearinghouse Association.¹³¹ The NYSE, Amex, and NASD would go on to jointly establish the NSCC in 1976. Importantly, because the NYSE and Amex were responsible for the lion’s share of U.S. equity trading volumes, 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 give the SEC authority to “facilitate the establishment of a national system for the prompt and accurate clearance and settlement of transactions in securities.”¹³² 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.”¹³³ Hence the development of centralized securities depositories.¹³⁴ 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.¹³⁵

¹²⁶ *See id.*

¹²⁷ *See id.*

¹²⁸ Securities Exchange Act Release No. 13163 (January 13, 1977) [File No. 600-15].

¹²⁹ *Id.*

¹³⁰ DTC *Annual Report 1* (1973) [on file with authors].

¹³¹ For example, this memorandum of understanding contemplated that the majority of DTC’s directors would be nominated by firms other than the NYSE; *id.*

¹³² 15 U.S.C. 78q-1(a)(2)(A).

¹³³ 15 U.S.C. 78q-1(e).

¹³⁴ *See, e.g.* Securities Exchange Act Release No. 20221 (Sept. 23, 1983), 48 Fed. Reg. 45167 (Oct. 3, 1983). Before the Act, NYSE established the Central Certificate Service to act as its depository. See History of DTCC <http://www.dtcc.com/about/history/>.

¹³⁵ *See id.*

By most measures, the SEC has been remarkably successful in realizing Congress's ambition to develop a centralized national system for securities clearing and settlement. Today, DTCC owns both DTC and NSCC. DTC acts as the depository for trillions of dollars of financial products, including publicly traded equities, municipal and corporate bonds, and derivatives.¹³⁶ Rather than physically exchange securities certificates, DTC maintains electronic records of securities ownership and simply updates these records whenever a trade is settled.¹³⁷ This process, known as automated book-entry, has led to billions of dollars in annual savings and dramatically reduced incidents—known as “fails to deliver” (or FTDs)—in which the seller fails to deliver the securities it has sold to the buyer.¹³⁸ During the Paperwork Crisis, these FTDs cost brokerage firms billions of dollars and led to the closure of over 150 institutions.¹³⁹

NSCC, too, has 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, and 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 A to pay Broker C, 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, the 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 Broker B fails, its counterparties would not be adversely affected if its obligations had been netted out because those obligations would have been 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 the use of multilateral netting, NSCC and DTC have thus eliminated trillions of dollars in bilateral counterparty credit risk.¹⁴⁰

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—

¹³⁶ See Corporate Finance Institute, *Overview of DTCC*, <https://corporatefinanceinstitute.com/resources/knowledge/trading-investing/depository-trust-and-clearing-corporation-dtcc/>.

¹³⁷ See DTC, Book-Entry, <http://www.dtcc.combookentry.html>.

¹³⁸ See The Clearing House, *What Are Fails?* (2017), <https://www.federalreserve.gov/regreform/rr-commpublic/tch-meeting-20171012.pdf>.

¹³⁹ See Robert J. Cole, *Record Stock Volume a Factor in Brokerage Crisis*, NY TIMES (Mar. 14, 1970), <https://www.nytimes.com/1970/03/14/archives/record-stock-volume-a-factor-in-brokerage-crisis.html> (“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.”); Bergman, *supra* note ___, 3 (“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 (NYSE) member firms went out of business while others either merged or liquidated.”).

¹⁴⁰ See *id.*

or “margin”—requirements.¹⁴¹ Each NSCC member is required to post margin, which is essentially a performance bond, to guarantee its obligations to deliver cash and securities to NSCC. The amount of margin that each member is required to post is calculated on the basis of, among other factors, the size, volatility, and concentration of their net unsettled positions.¹⁴² 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.¹⁴³

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 on its obligations, NSCC will first use the collateral that the defaulting party posted as margin against its outstanding obligations. If those funds prove insufficient, however, NSCC can tap into a dedicated default fund, financed by mandatory contributions from market participants as a condition of their membership.¹⁴⁴ NSCC employs similar mechanisms to guarantee the delivery of purchased securities.¹⁴⁵

The stated purpose of the 1975 amendments to the Securities Exchange Act was “to remove impediments to and perfect the mechanisms of a national system for the clearance and settlement of securities transactions.”¹⁴⁶ Viewed against the backdrop of the valuable roles that NSCC and DTC now play, that project appears to have been largely successful. Today, NSCC clears, reconciles, and settles the vast majority of securities transactions within two business days. 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.¹⁴⁷

III. Consolidation, Not Coordination

Yet the SEC failed to realize its congressional mandate in at least one important respect. While today securities clearinghouses and depositories are widely viewed as natural monopolies,¹⁴⁸ when Congress amended the Securities Exchange Act in 1975, the

¹⁴¹ For a more in-depth discussion of netting, see Craig Pirrong, *The Industrial Organization of Execution, Clearing and Settlement in Financial Markets*, University of Houston (Jan. 23, 2007), available at www.cba.uh.edu/spirrong/Clearing_silos.pdf.

¹⁴² See NSCC Rules & Procedures, *supra* note ___, Procedure XV.

¹⁴³ Discussing the benefits of a national system for clearing securities, the SEC explained that the failure of one clearing member could cause “systemic disturbance to financial markets and to the economy.” 10 Securities Transactions Settlement, Securities Act Release No. 8398, Securities Exchange Act Release No. 49405, Investment Company Act Release No. 26384, 69 Fed. Reg. 12922-01, 12926 (proposed Mar. 18, 2004).

¹⁴⁴ NSCC Rules & Procedures, *supra* note ___, Rule 4, Section 4.

¹⁴⁵ See *id.*

¹⁴⁶ See 15 U.S.C. § 77q-1.

¹⁴⁷ See TINA P. HASENPUSCH, CLEARING SERVICES FOR GLOBAL MARKETS 2.1.2.1 (2009) (“There is general consensus that smoothly running and efficient post-trade services are a necessary precondition for the efficient functioning of financial markets.”); Donald L. Calvin, *The National Market System: A Successful Adventure in Industry Self-Improvement*, 70 VA. L. REV. 785, 800 (1984) (“NSCC was conceived as the central element in an integrated nationwide effort to eliminate unnecessary duplication of post-trade activities and to permit single-account clearing and settlement for broker-dealers in the clearing organization of their choice.”); 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, 51, 65-66 (2011).

¹⁴⁸ See Manmohan Singh, Monetary and Capital Markets Department, the Int’l Monetary Fund, *Collateral, Netting, and Systemic Risk in the OTC Derivatives Market* (2015), <https://www.imf.org/external/pubs/ft/wp/2010/wp1099.pdf>; Darrell Duffie & Haoxiang Zhu, *Does a Central Clearing*

competitive landscape was dominated by a small group of regional clearinghouses and depositories. These regional clearinghouses and depositories were located in cities like New York, Boston, San Francisco, Chicago, and Philadelphia, where they provided exclusive clearing, settlement, and depository services to affiliated stock exchanges. It was the existence of these regional players that prompted Congress to explicitly list “*competition . . . among clearing agencies*” as one of the Act’s primary goals.¹⁴⁹ To that end, rather than grant a single clearinghouse or depository a monopoly, or permit the SEC to do so, Congress directed the Commission “to facilitate the establishment of linked or coordinated facilities for clearance and settlement of transactions in securities.”¹⁵⁰ Thus, rather than create a regulated monopoly, Congress consciously and explicitly opted to impose coordination requirements on this burgeoning 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 registrations designed to sever existing restrictive ties between clearing agencies and their affiliated securities markets.*”¹⁵¹ The SEC was also emphatic about the need 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 corporations.”¹⁵² On multiple occasions, the Commission even stated “that clearance and settlement is not a natural monopoly.”¹⁵³

The SEC’s focus on promoting competition was also reflected in the concerns of market participants and other regulators that NSCC and DTC would abuse their growing market power.¹⁵⁴ During the late 1970s, the SEC received comments from the regional

Counterparty Reduce Counterparty Risk?, http://www.mit.edu/~zhuh/DuffieZhu_CCP.pdf; BRETT M. FRISCHMANN, INFRASTRUCTURE: THE SOCIAL VALUE OF SHARED RESOURCES 12-14 (2012); 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), <http://www.imf.org/external/pubs/ft/wp/2013/wp1303.pdf>; Craig Pirrong, *Rocket Science, Default Risk, and the Organization of Derivatives Markets* (2008) (showing that the exposure at default to a portfolio of derivatives products is smaller than the sum of the exposures at default of the individual elements of the portfolio); Darrell Duffie and Haoxiang Zhu, *Does a Central Counterparty Reduce Counterparty Risk* (2011) (same); Douglas D. Evanoff, Daniela Russo and Robert S. Steigerwald, European Central Bank Conference, *The Role of Central Counterparties*, (2006) (“[F]ixed cost within CCPs made up the bulk of operational expenses and that 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.”), <https://www.ecb.europa.eu/pub/pdf/other/rolecentralcounterparties200707en.pdf?2973e97f821d65505808bd2a9662560e>.

¹⁴⁹ 15 U.S.C. 78-q(1)(a)(2)(A) [emphasis added]. The legislative history also suggests that Congress anticipated that the core component of a national market system would be an electronic communication linkage between existing markets. See Senate Report No. 94-75, at 3.

¹⁵⁰ 15 U.S.C. 78-q(1)(a)(2)(B)(ii).

¹⁵¹ Securities Exchange Act Release No. 13163, 39-40. [Emphasis added].

¹⁵² See *id.*; see also SEC Release No. 17562 (Feb. 20, 1981) (same).

¹⁵³ See *id.*; see also SEC Release No. 17562 (Feb. 20, 1981) (same).

¹⁵⁴ In fact, the SEC has consistently acknowledged that industry concentration is a problem but found that other considerations outweigh those concerns. See, e.g. Securities Exchange Act Release No. 17562 (Feb. 20, 1981) (“implicit in the discussion of clearing agency competition is the Commission’s conclusion that clearance and settlement is not a natural

clearinghouses, the Department of Justice (DOJ) antitrust division, and the FTC 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.¹⁵⁵ In 1977, in its Order approving NSCC's registration, the SEC, too, expressed concern "that competing clearing corporations would be unable to offer comparable services."¹⁵⁶

In response to these concerns, the SEC instructed NSCC and DTC "to establish full interfaces with continuous netting systems."¹⁵⁷ 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.¹⁵⁸ DTC and the regional depositories were similarly required to participate in a "Regional Interface Organization" (RIO), designed to ensure that all depositories could communicate with each other, "make[] the necessary book-entry movements" and, thereby, "enable clearing corporations to settle, by book-entry, trades between their respective participants."¹⁵⁹ 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 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.¹⁶⁰ NSCC therefore bore most of the costs of developing the necessary 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.¹⁶¹ 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 allow regional clearinghouses to use the

monopoly."); *id.* (approving registration on NSCC's ability to "meet[] four conditions designed to ameliorate the anticompetitive effects that NSCC's opponents feared"); 61 Fed. Reg. 1195, 1197 (Jan. 5, 1996) ("[T]he Commission recognizes that consolidation of core services poses a risk that support for innovative products, trading systems, and clearing procedures could flounder.").

¹⁵⁵ See Securities Exchange Act Release No. 20461 (December 7, 1983), 48 Fed. Reg. 55654. See also Securities Exchange Act Release No. 13163 (January 13, 1977), 42 Fed. Reg. 3916. 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 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 (SIAC). During Phase II, NSCC converted the separate clearing divisions into a single integrated entity, with the goal of providing all of the services that were previously provided by ASECC, NCC, and SCC. At the outset, this merger left NSCC with approximately eighty-five percent market share.

¹⁵⁶ 42 Fed. Reg. 3931 (Jan. 21, 1977).

¹⁵⁷ *Id.* The SEC further emphasized that "the availability of safe and efficient interfaces" supported "competition among clearing agencies." 48 Fed. Reg. 55654 (Dec. 14, 1983).

¹⁵⁸ 1989 SEC LEXIS 1343, *17.

¹⁵⁹ See Securities Exchange Act Release No. 20461 (December 7, 1983), 48 FR 55654 [File No. SR-DTC-77-10]. See also Securities Exchange Act Release No. 13163 (January 13, 1977), 42 FR 3916.

¹⁶⁰ NSCC Registration at 3933; *see also* 42 Fed. Reg. 3929-3935 (summarizing these requirements).

¹⁶¹ *See id.*

computer software NSCC developed for brokerage firms to compare prices offered on different exchanges and other trading platforms.¹⁶²

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 all the regional clearinghouses and depositories.¹⁶³ According to the SEC, these newly-registered clearing agencies together comprised “the core components of an integrated national clearance system Congress envisioned in its enactment of Section 17A.”¹⁶⁴ 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.”¹⁶⁵ At least in theory, Congress and the SEC had delivered on their promise to create an open and interoperable system for securities clearing and settlement—one that would enable NSCC, DTC, and regional clearinghouses and depositories to compete with each other on more or less 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 clearinghouses and depositories had halted their operations and transferred their functions and responsibilities to NSCC and DTC. Accordingly, while the SEC’s coordination requirements did eventually lead to the creation of a national market infrastructure, they did so not by establishing a truly open and interoperable network for securities clearing and settlement. Instead, as described below, interoperability and open access requirements ultimately contributed to the demise of the regional clearinghouses and depositories by imposing high fixed costs to connect to the new interfaces, allowing NSCC and DTC to dictate the direction and pace of innovation, and preventing firms from differentiating their products and services from those of their competitors.

¹⁶² See *id.* (“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 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.”).

¹⁶³ The Depository Trust Company Annual Report (1984), http://3197d6d14b5f19f2f440-5e13d29c4c016cf96cbbfd197c579b45.r81.cf1.rackcdn.com/collection/papers/1980/1984_0101_DTCAR.pdf (“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 National 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.”).

¹⁶⁴ 1989 SEC LEXIS 1343, *17.

¹⁶⁵ *Id.*

A. Boston

The Boston Stock Exchange (BSE) was the first to fall. Throughout the 1960s and 1970s, the BSE operated its own securities depository and clearinghouse. A BSE subsidiary, the New England Securities Depository Trust Company (NESDTC) provided depository services, and another subsidiary, the Boston Stock Exchange Clearing Corporation (BSECC), provided clearing and settlement services for trades executed on the BSE. The SEC granted both the NESDTC and BSECC temporary registration in 1975 as part of an omnibus Order granting the same status to NSCC, DTC, and each of the other regional clearinghouses and depositories.¹⁶⁶

Importantly, however, while these other clearinghouses and depositories all subsequently received full registration in 1983,¹⁶⁷ the SEC repeatedly extended Boston's temporary registration.¹⁶⁸ 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."¹⁶⁹ 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 elected to *outsource* its clearing and settlement functions to what, in theory at least, were its primary competitors.

When compared with the demise of 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.¹⁷⁰ To better understand the nature and source of these costs, it is important to first 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.¹⁷¹ Importantly, if a broker that held its primary account with NSCC sold a security to a broker that held its primary account with a regional clearinghouse, 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.¹⁷² 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

¹⁶⁶ See Securities Exchange Act Release No. 11875 (Nov. 26, 1975), 40 Fed. Reg. 55910 (Dec. 2, 1975).

¹⁶⁷ The eight-year delay was caused by antitrust litigation brought against NSCC. See *Bradford Clearing Corp. v. SEC*, 590 F.2d (D.C. Cir. 1978).

¹⁶⁸ Securities Exchange Act of 1934 Release No. 21335 (Sept. 20, 1984).

¹⁶⁹ *Id.*

¹⁷⁰ However, because BSE exited the clearing and depository markets so quickly, it is also possible that BSE did not want to comply with the other statutory requirements that did not involve linking with NSCC and DTC.

¹⁷¹ See Securities Exchange Act Release No. 17562 (Feb. 20, 1981).

¹⁷² See *id.*

automatically updating the ownership records.¹⁷³ 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 process and build communications systems to validate transactions that involved members of two or more clearinghouses. In an era before e-mail or the internet, where a single IBM mainframe computer cost upwards of \$5 million (and still could not communicate with another computer on the other side of the same room), compliance with these requirements demanded enormous investments in human, operational, and technological infrastructure.¹⁷⁴

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”¹⁷⁵ and placing “great strain on internal resources.”¹⁷⁶ Compounding matters, “development costs for an internal securities processing system can amount to millions of dollars.”¹⁷⁷ 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.”¹⁷⁸

In the end, developing this infrastructure proved too risky for the BSE. By 1983, every other regional clearinghouse and depository had developed a system for automatically transmitting information to NSCC and DTC.¹⁷⁹ Not so for BSECC and NESDTC.¹⁸⁰ 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 business.¹⁸¹ Rather than build its own infrastructure, the BSE chose instead to become a member of the NSCC and DTC.¹⁸²

It is worth noting that, unlike the other regional clearinghouses and depositories discussed below, it is not clear that interoperability and open access *caused* the BSE to leave

¹⁷³ The SEC and NSCC have continued to take steps to shorten settlement times. *See infra* Part 2.II.

¹⁷⁴ *See* Annual Report of the Federal Reserve Bank of Dallas, *Time Well Spent: The Declining Real Cost of Living in America* 18 (1997), <https://www.dallasfed.org/assets/documents/fed/annual/1999/ar97.pdf>.

¹⁷⁵ *See* Stephen Gardos, *State-of-the-Art Automation Provides Means to Boost Profits*, *AM. BANK.* (Dec. 5, 1984).

¹⁷⁶ *See id.*

¹⁷⁷ *See id.*

¹⁷⁸ *See id.*

¹⁷⁹ *See* 48 Fed. Reg. 45167.

¹⁸⁰ *See Id.*

¹⁸¹ Order Approving Proposed Rule Change, 48 Fed. Reg. 20189-01 n.11 (May 4, 1983) (“NSCC also was directed to establish appropriate free links with the Boston Stock Exchange Clearing Corporation and the now-deregistered TAD Depository Corporation BSECC is now linked with, and is a participant in National Securities Clearing Corporation.”).

¹⁸² *See* Securities Exchange Act of 1934 Release No. 21335 File No. 600-5 (Sept. 20, 1984).

the clearing and depository business. By its own admission, the BSE felt that it would have to make significant infrastructure investments if it wanted to continue to provide clearing and custodial services to its clients. Still, the BSE's decision to select NSCC and DTC to undertake these functions on its behalf, and the fact that NSCC and DTC were able to successfully absorb these functions, suggests that building its own infrastructure would have been costly and, ultimately, duplicative. At the very least, then, it is clear that open access and interoperability failed to accomplish their objectives of distributing the fixed infrastructure costs of building the National Market System in a way that promoted greater competition.

B. 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 subsidiaries: Pacific Clearing Corporation (PCC) and Pacific Securities Depository Trust Company (PSDTC). Unlike Boston's clearinghouse and depository, however, PCC and PSDTC received full registration from the SEC in 1983.¹⁸³ Yet just four years later, the PCX would also exit the clearing and depository business. 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 make sure that the parties both agree on the price, the number of shares being purchased and sold, and other terms and conditions. Until 1981, there were two competing OTC comparison and reconciliation systems in the U.S. market. One was operated by PCC, which provided services both on its own behalf and on behalf of the Chicago and Philadelphia clearinghouses. The other was operated by NSCC. 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 uncomparated trades."¹⁸⁴

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 broker to "use an automated comparison system for certain interdealer trades."¹⁸⁵ This rule sought to replicate the process that already existed for OTC transactions in other securities by centralizing and automating trade comparison. To comply with this rule, PCC decided to delegate responsibility for clearing and settling municipal securities to NSCC and DTC.¹⁸⁶ Once again, rather than develop the technological infrastructure

¹⁸³ See 48 Fed. Reg. 45167 (Oct. 3, 1983).

¹⁸⁴ 46 Fed. Reg. 58239 (Nov. 30, 1981).

¹⁸⁵ 1989 SEC LEXIS 60, *4-5.

¹⁸⁶ The Midwest Clearing Corporation (MCC) made the same decision. 1989 SEC LEXIS 60, *4-5, ("In addition to providing services to its own participants, NSCC will be providing centralized, automated comparison services to

necessary to expand its clearing and depository business to the multitrillion dollar municipal debt market,¹⁸⁷ PCC thus decided to outsource these functions to its biggest competitor. 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.¹⁸⁸

Crucially, even in those segments of the market where they were still ostensibly competing, it appears that PCC and PSDTC often failed to offer any real alternative to NSCC and DTC—even when brokers were clearing and settling trades on the PCX’s own platforms.¹⁸⁹ To comply with the SEC’s interface requirement, PCC and PSDTC implemented what was known as the National Institutional Delivery System (NIDS). NIDS was the interface that connected PCC and PSDTC to DTC’s system, enabling them to automatically clear, reconcile, and settle trades with participants of DTC and other registered clearinghouses and depositories.¹⁹⁰ 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.¹⁹¹ But when a PCC member broker executed a trade on any exchange other than the PCX, PCC and PSDTC had to relinquish responsibility for clearing and settling the trade to NSCC and DTC.¹⁹² 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 and updated DTC’s book-entry system, at which point they would submit the information back to PCC and PSDTC, which would update their own accounts and ensure final settlement.¹⁹³

This process was remarkable for at least two reasons. The first was its circuitousness. Trade information was relayed from regional clearinghouses and depositories to NSCC and

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 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.”)

¹⁸⁷ It is also possible that increased automation of custodial services also increased PSDTC’s costs. See Municipal Bond Markets, Annual Reviews, <https://www.annualreviews.org/doi/abs/10.1146/annurev-financial-110118-123034?journalCode=financial#:~:text=The%20municipal%20bond%20market%20is%20the%20largest%20and%20most%20important,new%20bonds%20issued%20each%20year>.

¹⁸⁸ MCC was in the same position for twelve years.

¹⁸⁹ See Stock immobilization: Order Approving Proposed Rule Change Instituting Same-Day Funds Settlement Service, Securities Exchange Act Release No. 24689, 52 Fed. Reg. 26613-01, 26616 & nn.20–21 (July 15, 1987) (discussing the progress and citing the Div. of Mkt. Regulation, Sec. & Exch. Comm’n, Progress and Prospects: Depository Immobilization of Securities and Use of Book-Entry Systems (1985)); Securities Transactions Settlement, Securities Act Release No. 8398, Securities Exchange Act Release No. 49405, Investment Company Act Release No. 26384, 69 Fed. Reg. 12922-01 (proposed Mar. 18, 2004); Transfer Agents Operating Direct Registration System, Securities Exchange Act Release No. 35038, 1994 WL 681687 (Dec. 1, 1994) (concept release); Ralph C. Ferrara & Konrad S. Alt, Immobilization of the Security Certificate: The U.S. Experience, 15 SEC. REG. L.J. 228, 235–42 (1987); Order Approving Proposed Rule Changes, 47 Fed. Reg. 51658-02, 51659–60 (U.S. Sec. & Exch. Comm’n Nov. 9, 1982) (describing a cooperative effort); see ALSO JERRY W. MARKHAM & THOMAS LEE HAZEN, 23A BROKER-DEALER OPERATIONS UNDER SECURITIES AND COMMODITIES LAW § 13:5 (PERM. ED., REV. VOL. 2015).

¹⁹⁰ 48 Fed. Reg. 3441 (Jan. 25, 1983). It also required 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.” SEC Release 19199 (Nov. 1, 1982).

¹⁹¹ See *id.*

¹⁹² See *id.*

¹⁹³ See *id.*

DTC and then back again. The second was that, even when PCC and PSDTC were nominally providing clearing and depository services, they were effectively being forced to rely on NSCC and DTC to undertake the majority of the work. In effect, 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 and DTC's existing infrastructure. In fact, when PCC and PSDTC finally transferred control over their clearing and custodial operations to NSCC and DTC in 1987, they expressly conceded that the "change . . . would eliminate the costly and redundant process for dealers who are not members of the National Securities Clearing Corporation."¹⁹⁴ 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 match, compare, and settle transactions. Thus, rather than eliminating redundancies, the SEC-mandated interface actually created them.¹⁹⁵

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 PCX and other regional exchanges to instead 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 was reported to command approximately eighty-seven percent of the U.S. depository market, dwarfing the four percent market share of the PSDTC.¹⁹⁶

Ultimately, for interoperability and open access 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 to not only use—but *rely* on—their rivals' infrastructure. Thus, the very regulations that were designed to prevent any single firm from obtaining a monopoly served to price the PCX out of the market and consolidate 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.¹⁹⁷ As explained by PCX Chairman Maurice Mann after the decision was announced: "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 purpose of the exchange—its trading function."¹⁹⁸ Among the rationales for the sale was that PCC and PSDTC would have needed to make a "tremendous investment in technology"¹⁹⁹ to compete with DTC's "sophisticated computer system."²⁰⁰ As one observer put it: 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

¹⁹⁴ SEC Release 23726 (Oct. 17, 1986).

¹⁹⁵ *See id.*

¹⁹⁶ *See* Robert Luke, *Exchange to Sell Nontrading Units*, AM. BANK. (Apr. 27, 1987).

¹⁹⁷ *See id.*

¹⁹⁸ *See id.*

¹⁹⁹ *See* Robert Luke, *Pacific Stock Exchange Wants to Shed Its Clearing and Depository Business*, Am. BANK. (Apr. 21, 1987).

²⁰⁰ *See id.*

New York's Depository Trust Co."²⁰¹ Rather than make these investments, PCX ultimately decided to shutter its clearing and depository operations and transfer them to NSCC and DTC.²⁰²

C. 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 (CHX²⁰³) 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.²⁰⁴ Later that year, these developments would enable incoming President Charles Doherty to strike a confident tone, stating 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."²⁰⁵

While Doherty was correct that U.S. securities markets would change dramatically over the course of 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 on October 19, 1987. Known as "Black Monday," the crash saw the Dow Jones Industrial Average decline by 22.6% in a single day²⁰⁶—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 just over 12%.²⁰⁷

Among the primary causes of the crash were quantitative trading models used to provide so-called "portfolio insurance" products.²⁰⁸ And while clearinghouses generally performed well, Black Monday did reveal that the regional clearinghouses were vulnerable during market disruptions.²⁰⁹ Specifically, despite having developed links with NSCC and DTC, the regional exchanges struggled to process the sheer volume of transactions triggered by the crash. Trade comparison processes in particular became a major "stress point," leading to late payments and increased error rates.²¹⁰ 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

²⁰¹ See Luke, Exchange to Sell Nontrading Units, *supra* note ____.

²⁰² See DTC Annual Report 25 (1987) [on file with authors].

²⁰³ The Midwest Stock Exchange changed its name to the Chicago Stock Exchange (CHX) in 1993.

²⁰⁴ See Laurie Cohen, *The Midwest: A New Home, Higher Profile*, CHICAGO TRIBUNE (Apr. 25, 1985).

²⁰⁵ See William Gruber, *3D Career is a Major Exchange*, CHICAGO TRIBUNE (Nov. 11, 1985).

²⁰⁶ See Kimberly Amadeo, *How Does the 2020 Stock Market Crash Compare with Others*, THE BALANCE (Apr. 27, 2020), <https://www.thebalance.com/fundamentals-of-the-2020-market-crash-4799950>.

²⁰⁷ See *id.*

²⁰⁸ See Division of Market Regulation, SEC, *The October 1987 Market Break 3* (February 1988),

²⁰⁹ See *id.* at 10-21 ("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 member clearing agencies enabled them to minimize or eliminate loss.").

²¹⁰ See *id.* at 10-5 and 10-16.

trades.²¹¹ The crash also tested the ability of clearinghouses to monitor the financial condition of member brokers and manage member defaults.²¹² As stated by the SEC 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.”²¹³

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 system as a whole [during the 1987 market break] was the danger of a major default of these clearing and settlement systems.”²¹⁴ Federal Reserve Board Chairman Alan Greenspan took a similar position, stating in congressional testimony that “[t]he overloading of the... clearing systems last October induced breakdowns that dramatically increased uncertainty among investors and likely contributed to additional downward pressures on prices.”²¹⁵ The United States Government Accounting Office summarized the clearing deficiencies that contributed to the crisis: “Due to large trading volumes and price volatility, many clearing organizations had processing problems, could not assess financial risk exposure to their member firms, did not have necessary funding, or did not make timely payments.”²¹⁶

In March 1989, an international organization known as the Group of Thirty, which was established to study securities clearing and settlement, made nine recommendations about how to improve these processes. The group concluded that the most serious deficiencies in the U.S. securities clearing and settlement system stemmed from how long it took to clear and settle trades.²¹⁷ 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.²¹⁸

²¹¹ *See id.* at 10-1.

²¹² *See id.* at 10-13 and 10-21.

²¹³ *See id.* at 10-2.

²¹⁴ Luncheon Address: Perspective on Payment System Risk Reduction by E. Gerald Corrigan, President, Federal Reserve Bank of New York, cited in Securities Exchange Act Release No. 33023 (October 7, 1993), 58 Fed. Reg. 52891 n16 (October 13, 1993).

²¹⁵ *See* statement of Alan Greenspan, Chairman of the Board of Governors of the Federal Reserve System, Securities Exchange Act Release No. 49405 (Mar. 11, 2004), 69 Fed. Reg. 12922, 12923 (March 18, 2004).

²¹⁶ United States General Accounting Office, Clearance and Settlement Reform: The Stock, Options, and Futures Markets Are Still at Risk, Report to Congressional Committees (Apr. 1990), <http://archive.gao.gov/d24t8/141098.pdf>.

²¹⁷ U.S. Working Committee, Implementing the Group of Thirty Recommendations in the United States (November 1990).

²¹⁸ 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 instruments were already settled in same-day funds. *See* Securities Exchange Act Release No. 35720 (May 16, 1995), 60 FR 27360 [File No. ST-DTC-95-06] (order granting accelerated approval to proposed rule change modifying the same-day funds settlement system). Two years later, a congressional report expounded on the Group of Thirty Report, saying that, in order to achieve T+3 settlement, the U.S. Working Committee recommended requiring book-entry settlement between financial intermediaries and between financial intermediaries and their institutional clients and depository eligibility for all new issuances. U.S. Working Committee, Implementing the Group of Thirty Recommendations in the United States (November 1990). *See* Bachmann Task Force

Over the next decade, the SEC, NSCC, and DTC worked to implement these recommendations, and by 1996, securities clearing transitioned to same-day funds settlement and T+3 securities settlement. In 1994, 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.”²¹⁹ When the rule went into effect in 1996, DTC and NSCC converted to same-day funds settlement.²²⁰ Not surprisingly, shortening the timeframe for securities and funds settlement required significant investments in technological and operational infrastructure.²²¹

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 (MTSC). In the immediate aftermath of the crash, the CHX had actually tried to expand into the market by offering its own depository services directly to brokerage firms and other institutional investors.²²² Yet by 1991, slower trading volumes—more than 20% off their pre-crash peak—had forced MTSC to lay off forty-eight of its approximately three hundred fifty employees.²²³ While the CHX would attempt to resuscitate this business in 1995, by this point the die had already been cast.²²⁴

On September 21, 1995, the CHX announced that it was selling MCC and MTSC to NSCC and DTC for \$22 million.²²⁵ Echoing the PCX’s stated rationale for exiting the clearing and depository business, CHX President Robert Forney explained that “[t]o profit in a rapidly evolving and fiercely competitive trading business, the exchange must streamline its focus on a core mission: securities trading.”²²⁶ The move was estimated to result in the elimination of two hundred fifty to three hundred back office jobs.²²⁷ 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.²²⁸ In the wake of the

on Clearance and Settlement Reform in U.S. Securities Markets, Report Submitted to the Chairman of the Securities and Exchange Commission (May 1992).

²¹⁹ See Rule 15c6-1, 17 C.F.R. § 240.15c6-1.

²²⁰ 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.” 61 Fed. Reg. 1196 (Jan. 17, 1996).

²²¹ See 82 Fed. Reg. 15564 (May 30, 2017) (describing the technological and infrastructure investments needed to reduce settlement times).

²²² See Diana Henriques, *Depository Skirts Bank Middlemen*, NY TIMES (Nov. 30, 1989).

²²³ See William Crawford, *Midwest Exchange Affiliate Lays Off 48*, CHICAGO TRIBUNE (Aug. 30, 1991); Charles Storch, *Chief Quits at Midwest Exchange*, CHICAGO TRIBUNE (Mar. 25, 1992) (reporting the drop in trading volumes over the preceding year).

²²⁴ See William Crawford, *Chicago Exchange Creates Certificate-Processing Unit*, CHICAGO TRIBUNE (May 18, 1995).

²²⁵ The CHX then became a member of both NSCC and DTC, thereby outsourcing its clearing and depository functions; see 82 Fed. Reg. 15564 (“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.”).

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 *Clearinghouse Services to Go; Chicago Stock Exchange*, CHICAGO TRIBUNE (Sep. 21, 1995).

²²⁶ See William Smith, *New Chicago Exchange boss Plays Catch-up With Nasdaq*, CHICAGO SUN-TIMES (Oct. 1, 1995).

²²⁷ See William Smith, *Chicago Stock Exchange Will Sell 3 Units; 300 Jobs to Go*, CHICAGO SUN-TIMES (Sep. 21, 1995).

²²⁸ See George Gunset, *Chicago Stock Exchange’s High-Tech Flair May Snare Locals*, CHICAGO TRIBUNE (Feb. 19, 1996).

CHX's announcement, the *Chicago Tribune* observed that "[t]his will end Chicago's history as a securities processing center, and it leaves the exchange an empty shell."²²⁹ Importantly, it also left NSCC and DTC responsible for over ninety-seven percent of the U.S. equity clearing and depository market.²³⁰

The CHX's decision to exit the securities clearing and depository business 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 Nasdaq—both of which used NSCC and DTC to clear and settle trades and, importantly, implement the shift to T+3 securities settlement and same-day funds settlement.²³¹

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 to NSCC and DTC: "where 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."²³² 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.²³³ In effect, the CHX was highlighting 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 business 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."²³⁴

The essence of the CHX's concern was that fragmented clearing and depository markets would be less successful than concentrated markets in 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, in order 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. All other things being equal, this means that *larger* clearinghouses and depositories—with more members, more collateral, and more capital—should be in a better position to weather financial storms. By exiting the market and transferring its business to NSCC and DTC, the CHX thus buttressed the resilience of the U.S. securities clearing and depository industries.

Lastly, as MCC itself again pointed out, interoperability requirements were themselves the source of unnecessarily high costs. When MCC requested SEC approval to cease providing clearing and custodial services, it observed that "[i]nterdepository and

²²⁹ See Smith, *supra* note ____.

²³⁰ See Daniel Dunaief, *Midwest Consolidation May Raise Banks' Cost of Settling Trades*, AM. BANK. (Sep. 29, 1995).

²³¹ Smith, *supra* note ____.

²³² 61 Fed. Reg. 1196 (Jan. 17, 1996).

²³³ *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.").

²³⁴ *Id.* at 1196.

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.”²³⁵ The depositories, too, argued that multiple depositories led to costly and duplicative systems. For example, when MSTC closed, it explained, in virtually identical language to MCC, that “interdepository 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 and MSTC in operating an interface would be eliminated.”²³⁶

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, interoperability ensured that MCC and MSTC had to update their IT 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 and DTC made technological improvements, interoperability effectively forced their competitors to follow suit.

In the case of the CHX, interoperability and open access 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 adaptation. Viewed from this perspective, the sale of the CHX’s clearing and depository businesses to NSCC and DTC likely had the effect of improving both the efficiency and stability of U.S. equity markets. Importantly, however, it also eliminated the last meaningful roadblock on NSCC and DTC’s path to monopoly.

D. 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

²³⁵ *Id.* (“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.”); *see also id.* at 1196 n.12.

²³⁶ 60 Fed. Reg. 61720 (Sept. 3, 1995).

and DTC.²³⁷ The President of 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.”²³⁸

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 actually broke down in the middle of the trading day on at least two occasions in 1996.²³⁹ 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 inexperienced staff and antiquated computer system, and without the money to remedy either problem.”²⁴⁰ The article went on to allege that the exchange had improperly borrowed money from SCCP’s accounts.²⁴¹

On June 18, 1997, SCCP and Philadep entered a consent decree with the SEC in which they agreed to cease providing clearing and depository services.²⁴² This consent decree 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.²⁴³ Moreover, SCCP and Philadep reported that they lacked the resources to retain member data, compare trades, and construct systems for communicating with NSCC and DTC.²⁴⁴ A few months after signing the consent decree, 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 SCCP’s restructured and limited clearance and settlement business.”²⁴⁵ PSCC and DTC also agreed to pay \$2 million for improvements to the firm’s data processing systems and placed \$3 million in a reserve fund.²⁴⁶ In stark contrast with the other regional clearinghouses and depositories, which all departed voluntarily, the PHLX was effectively forced to shutter its clearing and custodial businesses once the SEC found that its infrastructure was inadequate.

Ultimately, the PHLX could not afford to build the technological and operational infrastructure necessary to develop and maintain state-of-the-art clearing and depository services. Of course, interoperability and open access were supposed to reduce these costs by allowing the regional players to rely on the infrastructure developed by NSCC and DTC.

²³⁷ See Dunaief, *supra* note __.

²³⁸ See *id.*

²³⁹ See Joseph DiStefano, “Phila. Exchange to Sell Units”, PHILADELPHIA INQUIRER (May 22, 1997).

²⁴⁰ See Leslie Eaton, *SEC Inquiry at the Philadelphia Stock Exchange*, NYTIMES (Apr. 19, 1997), <https://www.nytimes.com/1997/04/19/business/sec-inquiry-at-the-philadelphia-stock-exchange.html>.

²⁴¹ See *id.*

²⁴² 67 Fed. Reg. 1259, 1259 (Jan. 9, 2002).

²⁴³ See *id.*

²⁴⁴ See *id.* (listing nine ways SCCP and Philadep failed to comply with recordkeeping, margin, and valuation requirements).

²⁴⁵ Securities Exchange Act Release No. 39444 (December 11, 1997), 62 Fed. Reg. 66703 (Dec. 19, 1997). The SEC was also concerned that SCCP was misusing customer funds. See *id.*

²⁴⁶ See Tom Belden, *Units of Philex Settle Charges*, PHILADELPHIA INQUIRER (Aug. 12, 1997).

Nevertheless, SCCP and Philadep still had to develop technological capabilities to comply with increasingly onerous clearing and depository rules and to connect with the NSCC's 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.²⁴⁷

Compounding matters, like PCC and MCC, SCCP and Philadep used NIDS to interface with NSCC and DTC when comparing and recording trades that involved multiple clearinghouses.²⁴⁸ In addition to building the communications infrastructure necessary to interface with NSCC and DTC, SCCP was thus forced to use the infrastructure developed by its principal competitors to clear a large proportion of its overall trade volumes. In effect, like MCC and PCC, the PHLX's customers were riding on NSCC and DTC's coattails. But doing so ensured that the regional clearinghouses and depositories offered essentially the same services as DTC and NSCC, leaving SCCP and Philadep little scope to distinguish themselves from their competitors. It is 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 interoperability and open access 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 interoperability and open access requirements actually contributed to the decline and eventual exit of the regional clearinghouses and depositories. As a preliminary matter, these requirements forced the regional players to incur the relatively high fixed costs of connecting to this new financial market infrastructure. Compounding matters, whenever NSCC or DTC made improvements to their own infrastructure, these requirements left the regional firms with no other choice but to do so as well. In this way, interoperability allowed NSCC and DTC to dictate the pace of their rivals' innovations and thus force 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, since firms with more collateral, more capital, and larger default funds were better able to absorb these

²⁴⁷ Eaton, *supra* note __.

²⁴⁸ SEC Release 37617 (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 interoperability and open access 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, it is possible that 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 greater choice and, ultimately, competition. Yet by requiring regional firms to use NSCC and DTC's rails, interoperability and open access 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.

IV. The Aftermath

Predictably, once DTCC gained complete control over U.S. securities clearing and depository markets, evidence emerged that suggested it might be abusing its monopoly position. Until 2009, the NYSE, NASD, and Amex each owned one-third of the shares in DTCC.²⁴⁹ As a result, the two dominant exchanges were part-owners of the clearinghouse and depository that, by 1997, served all of their principal competitors.²⁵⁰ The other owner, NASD, was made up of the country's largest broker-dealers.

DTCC's member-owners appear to have used this position to advance their broader business interests. For example, in 2006, DTC promulgated a rule that made it difficult for non-members, regional exchanges, and brokers that were not members of NASD to hold securities that are recorded in DTC's book-entry system.²⁵¹ The rule forced these non-member transfer agents to open accounts with their direct competitors.²⁵² If the non-member transfer agents declined to do so, they would have been unable to record securities ownership electronically, which at that point was required of all transfer agents.²⁵³ This rule triggered vociferous protests from firms that competed with NASD members, since it forced them to choose between opening accounts with their competitors and exiting the market. One competitor objected that DTC had "become a de facto regulator of the entire transfer agent industry" and argued that it was using its position as "a monopoly [to] engage[] in predatory, anti-competitive conduct with respect to its direct competitors."²⁵⁴ Over a

²⁴⁹ 1998 DTCC Annual Report http://rackcdn.com/collection/papers/1990/1998_0101_NSCCAR_3.pdf ("NSCC's common stock is owned equally by the New York Stock Exchange, Inc. (NYSE), the American Stock Exchange, Inc. and the National Association of Securities Dealers, Inc.").

²⁵⁰ Securities and Exchange Commission Release No. 34-52922 (Dec. 7, 2005), <https://www.sec.gov/rules/sro/dtc/34-52922.pdf> (stating that NYSE owned 29% of outstanding DTCC shares).

²⁵¹ See Securities and Exchange Commission Release No. 34-55816 File No. SR-DTC-2006-16, Notice of Filing of Proposed Rule Change Amending FAST and DRS Limited Participant Requirements for Transfer Agents (June 1, 2007).

²⁵² See *id.*

²⁵³ See *id.*

²⁵⁴ Letter from Steven Nelson, Chairman & President, Cont'l Stock Transfer & Tr. Co., to Nancy M. Morris,

decade later, similar objections were voiced after NSCC rules effectively forced online broker Robinhood to temporarily limit but orders in shares of GameStop and other popular “meme” stocks.²⁵⁵

Simultaneously, the exchanges that competed with the NYSE and Amex for equity trading volumes complained that NSCC charged excessively high membership fees.²⁵⁶ Since the exchanges that owned NSCC were exempted from these membership fees, the NYSE and Amex appear to have been using their control over NSCC to increase their competitors’ costs.²⁵⁷ One competitor, Nasdaq, even considered building its own securities clearinghouse and acquired BCC and SCCP’s clearing facilities to reduce the costs of clearing securities transactions.²⁵⁸ While Nasdaq ultimately decided not to clear its own transactions, it did so only after NSCC reduced prices in response to the prospect that Nasdaq would emerge as a competitor.²⁵⁹ The DOJ also expressed concern that NSCC was favoring its owner-exchanges, claiming that NSCC provided superior service to the NYSE and Amex by processing trades executed on those exchanges more quickly than those executed on their competitors’ platforms.²⁶⁰

In response to concerns that NSCC and DTC were favoring their parent exchanges, the SEC was eventually pushed to impose a series of corporate governance reforms. These reforms included forcing the NYSE and Amex to sell their shares in DTCC.²⁶¹ Today, DTCC is mutually owned by the banks and brokers that participate in it, with its corporate governance having 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.”²⁶²

Ultimately, once DTCC obtained a monopoly and began taking advantage of this position, the SEC felt compelled to take additional steps to prevent NSCC and DTC from extracting monopoly rents. Open access and interoperability requirements were supposed to allow regulators to avoid turning to more intrusive forms of monopoly regulation, such as price controls, strict oversight, or ownership changes. Yet in the end, because SEC-mandated coordination failed to prevent NSCC and DTC from gaining a dominant market position, regulators were forced to exert strict control over the DTCC’s governance—

Sec’y, U.S. Sec. & Exch. Comm’n 3 (June 20, 2007), <https://www.sec.gov/comments/sr-dtc-2006-16/dtc200616-12.pdf>.

²⁵⁵ See Matt Levine, *Reddit Traders on Robinhood Are on Both Sides of GameStop*, BLOOMBERG OPINION (Jan. 29, 2021), <https://www.bloomberg.com/opinion/articles/2021-01-29/reddit-traders-on-robinhood-are-on-both-sides-of-gamestop>.

²⁵⁶ Securities and Exchange Commission Release No. 34-52922 (Dec. 5, 2005).

²⁵⁷ See *id.*

²⁵⁸ See Nasdaq OMX Abandons US CCP Plans, TRADE (Oct. 30, 2009), http://www.thetradenews.com/news/Regions/Americas/Nasdaq_OMX_abandons_US_CCP_plans.aspx (“Nasdaq OMX said it had rethought its approach because it believes the threat of competition to the DTCC had achieved the exchange’s intended aims of lowering the cost of US equities trading, improving service and efficiencies and promoting innovation.”).

²⁵⁹ See *id.*

²⁶⁰ See Nasdaq OMX Abandons US CCP Plans, TRADE (Oct. 30, 2009), http://www.thetradenews.com/news/Regions/Americas/Nasdaq_OMX_abandons_US_CCP_plans.aspx.

²⁶¹ The Amex completed its divestiture in 2007. The NYSE took until 2009. See DTCC, Our History.

²⁶² BD. OF DIRS., DEPOSITORY TR. & CLEARING CORP., CHARTER 6 (2015).

including the radical step of forcing changes to its ownership structure—in order to prevent these firms from abusing their dominant position.²⁶³

3. OPEN ACCESS AND INTEROPERABILITY: POLICY IMPLICATIONS

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

More broadly, our analysis provides a cautionary tale about the logic and limits of coordination requirements. This cautionary tale could not come at a better time. In October 2020, the House of Representatives released a report that embraced open access and interoperability as a centerpiece of any future attempt to mitigate tech companies' market power.²⁶⁴ On the other side of the Atlantic, meanwhile, coordination requirements have been a key pillar in the European Union's attempt to build a single Capital Markets Union.²⁶⁵ Our analysis suggests that regulators should proceed carefully, and that interoperability and open access will not always be an effective way to capture scale economies, promote competition, or constrain market power abuses.

I. Interoperability and Financial Stability

The changing structure of the U.S. securities clearing and depository industries also sheds new light on the relationship between interoperability and systemic risk. As described in Part 2, 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 were unable to capture the economies of scale that would have enabled them to more effectively manage these potential threats to financial stability.

Over the longer term, of course, interoperability was also an important driver of the shift away from this fragmented industry structure and toward the current DTCC monopoly. Crucially, this shift in industry structure has been accompanied by a parallel shift in the

²⁶³ 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.

²⁶⁴ See House Digital Markets Report, *supra* note ___, 21.

²⁶⁵ See *e.g.* Markets in Financial Instruments Directive, 2014/65/EU (in force Jan. 3, 2018), Arts. 37 and 51. See also London Stock Exchange Group, Open Access: Myth-Busting, <https://www.lseg.com/resources/open-access/open-access-myth-busting>.

nature of the potential 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 (FSB), the global oversight body for systemic risk, the too-big-to-fail problem arises “when the threatened failure of a [systemically important financial institution]—given its size, interconnectedness, complexity, cross-border activity or lack of substitutability—puts pressure on public authorities to bail it out using public funds to avoid financial instability and economic damage.”²⁶⁶ 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. That is how the U.S. government responded to the failure of both Bear Stearns and Wachovia during the global financial crisis.²⁶⁷ Second, the government can itself agree to pay the firm’s debts, either to prevent the firm itself from failing or to prevent a cascading failure of other systemically important firms.²⁶⁸ This is the classic “bailout” of the variety that the government used to rescue global insurance giant AIG.²⁶⁹ Lastly, the government can simply roll the dice, let a systemically important firm fail, and face the consequences. This, of course, was the option that the government chose in response to the imminent failure of Lehman Brothers in September 2008.

The consensus view among commentators has long been that the failure of a major clearinghouse or depository would have catastrophic consequences for financial stability.²⁷⁰ Reflecting this consensus, the Financial Stability Oversight Council (FSOC) designated both NSCC and DTC as systemically important financial market utilities in 2012.²⁷¹ While NSCC and DTC would likely have been systemically important even if they were not monopolists,²⁷² 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, means that their failure would in all likelihood unleash chaos within global financial markets.

Notably, in the event that NSCC or DTC find themselves on the verge of failure, their dominant market position would further constrain the government’s already limited options. By definition, the fact that NSCC and DTC are monopolists in U.S. clearing and

²⁶⁶ See Financial Stability Board, “Evaluation of Too-Big-to-Fail Reforms: Summary Terms of Reference” 1 (May 23, 2019), <https://www.fsb.org/wp-content/uploads/P230519.pdf>.

²⁶⁷ FIN. CRISIS INQUIRY COMM’N, THE FINANCIAL CRISIS INQUIRY REPORT 343 (2011), http://fcic-static.law.stanford.edu/cdn_media/fcic-reports/fcic_final_report_full.pdf

²⁶⁸ See Casey and Posner, *supra* note ___, 481.

²⁶⁹ See, e.g., *The AIG Rescue, Its Impact on Markets, and the Government’s Exit Strategy*, Cong. Oversight Panel (Jun. 20, 2010), <https://www.govinfo.gov/content/pkg/CPRT-111JPRT56698/pdf/CPRT-111JPRT56698.pdf>.

²⁷⁰ See e.g., Bernanke *supra* note __.

²⁷¹ Designated Financial Market Utilities, BOARD GOVERNORS FED. RES. SYS., http://www.federalreserve.gov/paymentsystems/designated_fmu_about.htm.

²⁷² In fact, the SEC commented on their systemic importance even before all of the regional clearinghouses and depositories exited the market.

depository markets forecloses the possibility of a strategic sale to one of their competitors.²⁷³ For the same reason, and especially given the importance of clearing and settlement to the smooth and efficient functioning of financial system, it is simply not credible to expect the government to let either of these firms fail. That leaves a government bailout as both the most effective and most likely option in the event that one or both of these institutions ever finds itself on the brink of collapse.²⁷⁴

Any future government bailout of NSCC or DTC would be costly for two principal reasons. First, 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.²⁷⁵ Second, and more broadly, taking these firms into public ownership would be politically fraught and potentially deter private industry from entering the markets for clearing and settlement services. By pricing regional clearinghouses and depositories out of business, interoperability and open access requirements have made it more difficult and costly for the government to resolve these essential financial market infrastructures. In this way, SEC-mandated coordination requirements may have inadvertently exacerbated the too-big-to-fail problem.

Viewed from this perspective, interoperability represents something of a double-edged sword. On the one hand, while interoperability increases interconnectedness and potential contagion, and can prevent firms from capturing economies of scale that might help them better manage and mitigate systemic risks, it simultaneously ensures a degree of substitutability, together with the existence of other firms that might conceivably absorb the business of their 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, this will result in essential products and services being provided by a small handful of very large firms. While economies of scale may put these firms in a better position to manage and mitigate potential risks, their size, interconnectedness, and lack of substitutability will inevitably make them too-big-to-fail. Accordingly, where interoperability requirements lead to industry consolidation and monopoly, this will leave government ownership as the only credible option in a crisis, thereby reinforcing the too-big-to-fail problem and fomenting potential systemic risks.

²⁷³ 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 would be able to take over NSCC's operations.

²⁷⁴ 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 FDIC can provide support to a failing firm's counterparties. In addition, Congress has proposed complementing OLA by creating a Chapter 14 of the Bankruptcy Code to help recapitalize systemically important financial institutions. See Senate Judiciary Committee Hearing on Bankruptcy for Banks and Proposed Chapter 14, <http://blogs.harvard.edu/bankruptcyroundtable/tag/chapter-14/>.

²⁷⁵ For a discussion of bailouts, see Anthony J. Casey & Eric Posner, *A Framework for Bailout Regulation*, 91 NOTRE DAME L. REV. 479 (2015).

II. Interoperability as a Remedy in Antitrust

The DTCC's path to monopoly also has important implications for competition law and antitrust remedies more broadly. In theory, interoperability and open access 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 amongst market participants, interoperability and open access are also designed to reduce barriers to entry. In doing so, they eliminate the need for new entrants to make significant and potentially redundant infrastructure investments and, thus, promote greater competition.

So why did the SEC's interoperability and open access requirements not only fail to promote competition, but ultimately become one of the instruments by which the DTCC obtained its current 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 the majority of the costs associated with the *development* of clearing and depository interfaces on NSCC and DTC.²⁷⁶ Yet in hindsight the SEC clearly neglected to consider another important source of costs: the need for market participants to *connect* to, *maintain*, and ensure *ongoing compatibility* with, these interfaces.

Importantly, to provide clearing and depository services, the regional clearinghouses and depositories still had to construct their own technological, operational, and human infrastructure.²⁷⁷ Regional clearinghouses had to develop the automated systems needed to clear and settle financial transactions. Regional depositories, meanwhile, had to develop expensive systems to electronically record and update trade information. 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. Compounding matters, the regional clearinghouses and depositories had to make additional investments to develop systems for communicating with both NSCC and 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, importantly, were largely duplicated across NSCC, DTC, and each of the regional clearinghouses and depositories.

The existence of these ongoing costs highlights the conditions under which coordination requirements are likely to be effective. Specifically, unless the fixed costs of building, connecting, and, importantly, updating common infrastructure can be equitably allocated amongst market participants, the ongoing technological, operational, and other demands of interoperability may ultimately have anticompetitive effects. Most importantly, in the presence of 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 over time. Where these costs are not readily

²⁷⁶ See supra Part 2.III.

²⁷⁷ See supra Part 3.III.

divisible, or where the allocation mechanism does not account for these potential distortions, interoperability may ultimately lead to industry consolidation.

The second reason why the SEC's coordination requirements—and specifically 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 innovation and investment. As 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 system. 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 to either adopt the same improvements or exit the marketplace. For example, when NSCC and DTC invested in cutting edge computer systems in the 1990s in order to facilitate T+3 securities/same-day funds settlement, interoperability demanded that the remaining regional players make significant investments in new technology capable of facilitating these faster settlement times.²⁷⁸ Understandably, rather than making these enormous and essentially redundant investments, each of the remaining clearinghouses and depositories eventually sold or surrendered their businesses to NSCC and DTC.

The fact that NSCC and DTC had significant influence over the rollout of any improvements to the securities clearing and depository infrastructure—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 eliminating these distortions is not possible, 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.²⁷⁹ Before converting into a publicly-traded corporation in 2008, Visa was organized as a not-for-profit entity that licensed its core technological infrastructure and network access to member banks. This licensing arrangement had two key features. First, license fees were based on network *usage*: with larger banks, generating higher transaction volumes, paying a larger share of fees than their smaller rivals. Simultaneously, any fees generated in excess of Visa's operating costs were automatically reinvested back into the network. Second, despite this differential economic treatment, Visa's governance structure reflected a "one share, one vote" model pursuant to which all member banks—regardless of size—had an equal say on major decisions such as investments in network improvements.

This unique arrangement yielded a number of benefits. First, because Visa's license fees were based on transaction volumes, larger banks paid a higher proportion of both its

²⁷⁸ See *supra* Part 2.III.

²⁷⁹ For a detailed history of Visa Inc. and its predecessors, see PAUL CHUTKOW, *VISA: THE POWER OF AN IDEA* (2001).

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 within the credit card market.²⁸⁰ Second, by organizing as a not-for-profit entity and retaining excess fee revenue, Visa was able to pool capital for the purpose of making large investments in new technology. Amongst 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. 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. This gave member banks ample room to compete along other dimensions—including interest rates, reward programs, and other card features. Accordingly, while these specific arrangements are perhaps unique to Visa’s circumstances, this example demonstrates how thoughtful pricing and governance structures can help promote the coordinated development of interoperable networks that both capture economies of scale and provide an effective counterweight against any momentum towards monopoly.

The third and final reason why the SEC’s coordination requirements failed to prevent monopoly control is that open access and interoperability prevented market participants from effectively competing with each other. Here interoperability morphed into a form of highly standardized outsourcing. This may have occurred because of high infrastructure costs, or because the interfaces were poorly designed. Either way, when regional clearinghouses and depositories developed interfaces with NSCC and DTC, they often used the infrastructure NSCC and DTC had already constructed to clear and settle most trades.²⁸¹ This obviated 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 interoperability and open access 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 example, gas pipeline owners are required to allow shippers to bid for pipeline capacity.²⁸² Bidders that submit qualifying rates are entitled to use the pipeline.²⁸³ While open access and interoperability in gas markets prevent discrimination, 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. And 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

²⁸⁰ Following the elimination of restrictions on inter-state banking, and the resulting emergence of national retail banking giants such as Citigroup, Bank of America, and JP Morgan Chase, this subsidy became a source of significant tension, ultimately contributing to the decision to convert Visa into a for-profit, publicly-traded corporation.

²⁸¹ See *supra* Part 3.III.

²⁸² See Order 436, 50 Fed. Reg. 42408 (Oct. 18, 1985) (ordering open-access in gas pipelines).

²⁸³ See *id.*

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 favor 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 be competing with each other to provide *substitute* products and services. This competition is not necessarily 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. This enables shippers to take full advantage of available cargo space, while simultaneously promoting competition in the market for shipping containers. Crucially, one of the keys to this success is the fact 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 transmission line owners, where firms must build transmission lines that provide the same voltage but are permitted to try to develop cheaper and more durable lines.²⁸⁴

Nevertheless, problems start to arise where one or more firms in a horizontally interoperable market provide critical *intermediate* components of their competitors' products.²⁸⁵ 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 where the suppliers of these intermediate products also use them in their own final products.²⁸⁶ 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 effectively foreclose the possibility of 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 IT, operational, and other post-trade infrastructure developed by NSCC and DTC is extremely important. As a practical matter, this reliance meant that the clearing, settlement, and depository services provided by NSCC, DTC, and their regional competitors were—from the perspective of their customers—essentially identical. 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 overall service quality, legally-mandated interoperability also effectively prevented them from launching a slower, lower quality service designed to compete with NSCC and

²⁸⁴ See Ari Peskoe, *The Transmission Syndicate*, 42 ENERGY L.J. (2021) (forthcoming) (manuscript on file with authors).

²⁸⁵ An "intermediate" component, good, or product is one that is used to create a final product. Thus, for example, flour is an intermediate product in the creation of bread.

²⁸⁶ 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.

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.

III. Benefits of Open Access and Interoperability

It is worth noting that open access and interoperability requirements do not always generate anticompetitive effects. While these requirements exacerbated NSCC and DTC's market power, in other markets they have offered a viable alternative to monopoly.²⁸⁷ The history of securities depositories and clearinghouses therefore does not suggest that open access and interoperability requirements have no place in the arsenal of antitrust remedies. It simply 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.

Ultimately, whether this outcome is desirable depends on whether it is preferable to organize a given market as a monopoly or forfeit the scale economies that would exist when a single firm controls an entire market. In the case of securities clearinghouses and depositories, regulators were unable to replicate scale economies without allowing individual firms to enjoy a monopoly in their respective markets. This, in turn, enabled DTCC, the parent of NSCC and DTC, and its owners to exert market power.

Yet in the case of clearinghouses and depositories, open access and interoperability requirements seem to have had salutary effects despite failing to prevent NSCC and DTC from obtaining monopolies. We now know that NSCC and DTC likely *should* be monopolies. Viewed in this light, when there is uncertainty about whether a particular market is a natural monopoly, open access and interoperability requirements may be beneficial as a means of determining whether scale economies in fact exist. In compelling securities clearinghouses and depositories to coordinate with each other, policymakers were able to avoid identifying the optimal market structure by regulatory fiat and instead allow the market, over time, to determine whether securities clearinghouses and depositories were best controlled by a single firm. While this of course demands that policymakers identify and ideally eliminate any distortive effects of their own coordination requirements, well designed open access and interoperability requirements may thus facilitate the revelation of valuable information about the optimal structure of a given market.

In addition, even after NSCC and DTC obtained their monopolies, open access and interoperability requirements may have continued to discipline their behavior. 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.²⁸⁸ At the time, Nasdaq argued that it would be able to take market share from NSCC by offering cheaper products and services.²⁸⁹ The

²⁸⁷ See supra Part 1.III.

²⁸⁸ See supra Part 3.II.

²⁸⁹ See Traders Magazine, *Nasdaq Plans To Compete with the NSCC* (Oct. 16, 2008), <https://www.tradersmagazine.com/departments/clearing/nasdaq-plans-to-compete-with-the-nsc/> ("Nasdaq is targeting a range of customers interested in shrinking their clearing expenses. 'We're looking to get bulge-bracket firms, regional firms and hyperactive electronic firms that are self-clearing to use our facility,' [Nasdaq senior vice president of transaction

existence of interoperability and open access requirements meant that, had Nasdaq succeeded in developing its own clearinghouse, it would have immediately had access to the entire market and been able to compete directly with NSCC and DTC. In reducing their clearing and depository fees, NSCC and DTC were responding to the threat of competition. Crucially, the reason why Nasdaq's threat seemed credible was that the SEC's open access and interoperability requirements put it in a position to immediately challenge NSCC and DTC's dominance. The existence of these requirements thus continues to exert pressure on NSCC and DTC, even though the absence of any competitors means that they no longer maintain the technological and operational interfaces.

Finally, the existence of the SEC's open access and interoperability requirements means that, if future technological advances in the markets for securities clearing and depository services one day undercut their status as natural monopolies, new entrants will be in a relatively strong position to challenge incumbent firms. Indeed, while it was prohibitively expensive for multiple small firms to invest in the IT infrastructure necessary to build state-of-the-art clearinghouses and depositories in the 1980s and 1990s, falling technology costs mean that may soon no longer be the case. Along a similar vein, it is possible that distributed ledger technology could offer an alternative to centralized clearinghouses and depositories²⁹⁰—although here significant questions remain about whether, and how costly, it would be to ensure that these ledgers were compatible with existing infrastructure.²⁹¹ The existence of open access and interoperability requirements ensures that new entrants will be able to demand non-discriminatory access to the incumbents' platforms and, therefore, decrease barriers to entry. At the very least, these coordination requirements force NSCC and DTC to remain vigilant to the possibility of technological disruption, which creates at least some incentive for them to keep prices low and offer high quality clearing and depository services.

CONCLUSION

A recurring theme within the revitalized antimonopoly movement is that coordination requirements offer a potential solution to problems of market power. Yet not only did the SEC's open access and interoperability requirements ultimately fail to prevent

services Brian Hyndman said. 'Firms that are focused on scale and that want to reduce these variable expenses are in our sweet spot.'").

²⁹⁰ See Randy Priem, *Distributed Ledger Technology for Securities Clearing and Settlement: Benefits, Risks, and Regulatory Implications*, 6 FIN. INN. 7 (2020).

²⁹¹ Amongst other questions, it is not clear how technologists' visions of "real time" (and therefore *gross*) securities clearing and settlement via DLT could be made compatible with the existing deferred *net* clearing and settlement system. Ultimately, unless NSCC and DTC voluntarily decide to adopt DLT, and thus open themselves up to potential new competition, it is therefore 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 Mooney, *Beyond Intermediation: A New (Fintech) Model for Securities Holding Infrastructures*, 22 U. PENN. BUS. L. REV. 386 (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 and deferred net clearing and settlement systems would potentially serve as an additional barrier to the emergence of depository systems based on DLT.

NSCC and DTC from obtaining and entrenching their dominant market positions—they actually helped pave the DTCC’s path to monopoly. The history of the regional clearinghouses and depositories thus represents an illuminating case study and, in many respects, a cautionary tale. Open access and interoperability may be useful policy tools. But to ensure that these requirements do not end up exacerbating the market power of big tech, finance, and energy companies, policymakers should consider whether they will actually reduce the need for firms to make duplicative infrastructure investments, whether they enable dominant players to dictate their rivals’ investments in new innovation, and whether they leave room for firms to differentiate themselves from their competitors.