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Contested de/centralisation: NASDAQ, the national market system, and the politics of 'the market for markets'

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ABSTRACT

Through an institutional analysis of US capital market structure in the 1970s, this paper traces how centralisation and decentralisation became politicised as competing organisational principles in financial markets. I analyse how the creation of NASDAQ's (National Association of Securities Dealers Automated Quotation system's) decentralised system of market makers challenged the Securities and Exchange Commission's (SEC's) proposed 'Central Market System', examining debates between industry leaders, regulators and market engineers over market organisation. Rather than representing a stable characteristic of traditional finance, centralisation was a politically contested ideal that faced resistance from those advocating for competitive, fragmented and networked market structures. By examining how de/centralisation functioned as a political and technical concept in these earlier debates, this paper demonstrates that traditional finance contained multiple politically contested forms of centralisation, fragmentation and decentralisation.

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1. Introduction

In the 1974 press release announcing Friedrich von Hayek's Nobel Prize in Economic Sciences, the Royal Swedish Academy praised Hayek for concluding that 'only by far-reaching decentralization in a market system with competition and free price-fixing is it possible to make full use of knowledge and information' (Nobel Prize Outreach, 1974). Perhaps by coincidence, the same year, the Commissioner of the United States Securities and Exchange Commission (SEC) Philip A. Loomis Jr. reversed his position on the role of centralisation in the structure of the capital market industry. Prior to 1974, Loomis held the view that centralisation was necessary to the structure of financial markets because centralisation provided a single place where all market orders could converge thereby maximising the liquidity of the market. However, in 1974 he revised his position, observing that 'It is no longer necessary for lack of any other technically feasible method, to bring all orders together on one floor' and that 'the time has come to rely more on the forces of competition to discipline market maker's performance' (Loomis, 1974, pp. 5–6). Whereas centralised marketplaces were long assumed to be necessary for the aggregation of supply and demand to improve the liquidity and price discovery mechanism of markets, technical innovations in the 1970s make the prospect of 'decentralised' market systems part of the technological and regulatory imaginary.

In economic history, the debate between centralisation and decentralisation was framed by Hayek (1945) who set centralised (state) planning in opposition to decentralised (market) driven planning. The core thesis, as articulated by Hayek, is that decentralisation is necessary because useful, new and surprising information is not centrally located; it is distributed among dispersed actors (Hayek, 1945). Individuals, given their unique access to local data, have opportunity to act on information that, if it were aggregated and averaged by a central authority, would lose its distinctive value and timeliness. For Hayek, the price mechanism enables locally situated individuals to communicate economically relevant information without a central authority. Following Polanyi (1944/2001), social studies of finance have shown that Hayekian arguments in favour of spontaneous market-driven economic coordination often minimise a crucial factor: the

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price mechanism operates through market *places*, i.e., local institutions that centralise, aggregate and standardise the goods, information and rules that form the conditions of possibility for economic competition (Callon, 1998; MacKenzie, 2008; Pardo-Guerra, 2019). These centres of marketisation are not a free gift of nature; they are a product of labour, design choices and engineering efforts which, historically, have involved the direction of state authorities and industrialists (Block & Somers, 2014; Callon, 1998; Callon, 2016). However, as Hayekian economic theories of centralisation and decentralisation became more prominent in the 1970s, designers of capital markets and their infrastructures faced a conundrum: if centralisation is necessary to bring orders together, how should one balance the need for competition within a marketplace against competition between marketplaces in the national 'market for markets'? One centralised marketplace would maximise competition within that market, but at the expense of minimising competition between marketplaces.

This article examines the historical opposition to centralisation in financial markets by analysing debates over US capital market structure in the 1970s. Rather than treating centralisation and decentralisation as stable or opposing features of financial systems, I show how they emerged as contested ideals in struggles over market organisation. The opposition between centralisation and decentralisation as organising principles in financial markets became especially acute in the 1970s when the New York Stock Exchange (NYSE) and the Securities Exchange Commission collaborated on a proposed 'Central Market System' which, were it ever achieved, would have built a nationally centralised trading venue to coordinate the price discovery mechanism of all listed exchanges in the United States (Kennedy, 2017; Pardo-Guerra, 2019). However, during the same period, the National Association of Securities Dealers (NASD), a self-regulatory organisation (SRO) of broker-dealers, created comparatively decentralised automated quotation system called the National Association of Securities Dealers Automated Quotation system (NASDAQ) to support financial trading between broker-dealers at a national scale (NASD, 1971b; SEC, 1963, p. 664). This networked electronic market distinguished itself from geographically centralised exchange venues like the New York Stock Exchange. Further, the technological imaginary surrounding this computerised network challenged the NYSE's proposed 'Central Market System'. NASDAQ's success in creating what its architects called a 'decentralized network of competing market makers' fundamentally altered regulatory discourse around market structure, shifting focus from unified state regulation and centralisation toward technological solutions and inter-market competition (McGowan, 1991, p. 12).

Through archival analysis of regulatory documents, industry reports and technical specifications from the 1970s, this study reveals how decentralisation materialised in market infrastructure not simply as a technical innovation but as a contested political resolution to problems of fragmentation, monopolisation and market concentration. As Pardo-Guerra (2019) demonstrated, these debates problematised the infrastructural arrangement of markets by questioning whether all securities orders should flow through a single centralised exchange floor. In the context of this debate, NASDAQ's computerised peer-to-peer network of brokers provided a tangible answer by demonstrating that technology could reorganise market structure in ways previously impracticable. Whereas decentralisation is often presented as an exit from state institutions, I ground this earlier form of 'decentralised finance' in relation to regulatory discourse and statecraft, showing how policy makers actively promoted decentralised market competition as an alternative to traditional regulation.

This history reveals that centralisation was never a given feature of traditional finance. Instead, centralisation was a deliberate organisational choice that faced significant resistance and was ultimately rejected in favour of a complex financial system that incorporated aspects of centralisation and decentralisation. Rather than treating centralisation and decentralisation as opposing modes of organisation, I demonstrate how they function as complementary historical processes. This matters because a growing body of scholarship has shown that 'decentralisation' is itself an unstable and contested category rather than a neutral technical descriptor, one that frequently obscures persistent concentrations of power even in ostensibly distributed systems (Bodó et al., 2021; Golumbia & Simanowski, 2016; Schneider, 2019; Walch, 2019).

2. Materials and methods

Using tools from social studies of finance and science and technology studies, this article seeks to historise how market infrastructures were constructed through contestations between financial market leaders,

engineers and policy makers. Social studies of finance and science and technology studies have documented ways in which economic ideals are reified in market technologies and infrastructures (Callon, 1998; MacKenzie, 2008; Pardo-Guerra, 2019; Zaloom, 2006). This tradition, following Polanyi (1944/2001), treats markets as concrete social institutions rather than the abstract price-equilibrating spaces of neoclassical theory (Pardo-Guerra, 2019). Such work critically addresses the construction of infrastructural power, decentring technologically deterministic narratives by highlighting the role of both state and private actors in shaping the structure and outcomes of market infrastructure (Handel, 2025; Pinzur, 2025). It is in this concrete, infrastructural register that the present article situates the tension between centralisation and decentralisation: not as properties economic systems possess, but as mutating ideals that are assembled, enacted and therefore contestable. However, historiography of financial market infrastructures has largely focused on singular exchanges such as the NYSE (Kennedy, 2017), the London Stock Exchange (Pardo-Guerra, 2019) and The Chicago Board of Trade (Zaloom, 2006) or on individualised connectivities such as historic telecommunication lines (Handel, 2022) and contemporary high-frequency trading infrastructure (MacKenzie, 2021). While this work shows how.

The material systems that have historically structured the relations of competition and commensurability between multiple exchanges, what Pardo-Guerra (2019, p. 304) called the 'infrastructures of infrastructures', have drawn far less sustained attention, even as scholars increasingly recognise the infrastructural power that contemporary exchange platforms now exert over global financial marketplaces (Petry, 2021). This article takes up the interstitial level directly, and in doing so brings into view a tension that does not arise within any single market. Within an exchange, centralisation and competition are complementary: a venue centralises precisely in order to make competition among its participants orderly. It is only across venues that the tension between these organising principles comes into sharper focus, because the centralisation that deepens competition *within* a market can foreclose competition *between* markets. Situating the National Market System within the intermarket competition among the NYSE, NASDAQ and the regional exchanges makes this trade-off legible. De/centralisation thus appears not as a property an economic system possesses or lacks, but as a contest over where, across the layers of a national market for markets, competition and centralisation should each be located.

I extend this method of historising market infrastructure (see Pardo-Guerra & Pascal, forthcoming) to examine how mid-twentieth-century debates over inter-market competition and coordination prefigured contemporary discussions about decentralisation. This study focuses on how, through the attempt to regulate the market for markets, the political-economic problems of monopolisation, centralisation and market concentration became reframed as technical problems requiring infrastructural solutions. Concretely, this means tracing how economic and technical conceptions of de/centralisation were successively rearticulated from a geographic descriptor to an organisational principle of competitive market-making, to a regulatory rationale.

The analysis draws on archival materials from the Hagley Business Archives, the Charles Babbage Computer History archives and the NYSE archives, as well as online archives and repositories including the SEC Historical Society archives and Archives.org. Throughout the analysis I focus on key industry leaders such as executives, engineers and commissioners from the NYSE, NASDAQ and the Securities and Exchange Commission (SEC) in order to underscore the political decision making involved in producing and reproducing market infrastructure. Owing to the lack of publicly accessible NASDAQ archives,[1] the activities of NASDAQ actors were triangulated through NASD notices, regulatory and congressional hearings, technical documents, board members' personal archives and references to NASDAQ found in competitors' archival collections.

3. The historical development of decentralisation

In the context of financial markets, the meaning of decentralisation developed over time and became associated with different geographic, technical and political valences. In this section, I focus on the early development of the concept of decentralisation and its application in financial markets during the 1970s. Although financial 'decentralisation' now denotes a 'competitive, contestable, composable and non-custodial financial ecosystem built on technology that does not require a central organisation to operate' (Auer et al., 2023, p. 1), I will document how the concept of decentralisation was originally used by financial actors

as a geographic concept aimed at distinguishing spatially centralised exchange floors from geographically dispersed market networks.

3.1. Geographic origins of 'decentralised finance'

In the archival documents surrounding US capital market industry discourse, the term 'decentralisation' emerged primarily as a geographic concept. Prior to the 1970s, financial exchanges were largely spatially concentrated, floor-based, urban centres. As George Beltz (1972), a lead engineer of NASDAQ's original automated quotation system put it:

> Listed securities are, in general, traded only on the floor of an exchange – in essence, a central marketplace … OTC [over-the-counter] securities, on the other hand, are traded in a vast decentralized market place, by thousands of broker dealers scattered nationwide (p. 1009).

Beltz' uses of the words 'central' and 'decentralized' in this context does not reference the Hayekian opposition between centralised and decentralised planning. Rather, the engineer is marking the distinction between *where* securities are traded: a spatially concentrated exchange floor or a network of broker dealers. Listed securities were traded on registered exchanges such as the NYSE. Over-the-counter (OTC) securities which, prior to NASDAQ, were traded through an informal network of brokers (Ferderer, 2008). Registered exchanges were organised around trading floors: physical venues that brought people together face-to-face in a centralised location. These institutions continued the centuries-old pattern of stock exchanges as a central meeting point for securities trading (Michie, 2000; Sobel, 1965, 1972). As exchanges developed, the architects of these sites of exchange optimised the design of these venues, further entrenching the centrality of financial centres (Easley et al., 2014; Sassen, 1991; Zaloom, 2006).

The geographic concentration of market activity was not incidental to market function. Before electronic information technology, the principal way of finding willing buyers and sellers of securities was to bring their representatives into one room (Sobel, 1965). The centrality of the floor and, at larger scale, of the financial centre, was thus the material form that markets for securities historically took.

Following the development of the telegraph and the telephone, geographically dispersed markets began to complement the long-existing floor-based exchanges. Compared to registered exchanges, which occupied clear geographic locations, the OTC market lacked a specific centre of operations. Rather than concentrating trading behaviour in one geographic place, OTC markets leveraged nascent information technology (first the telegraph, then the telephone and eventually digital computing networks) to spread price signals across wider regions, effectively creating markets which persisted through the social and technical relationships between brokers rather than through the floor-based architectures and central meeting places of prior exchanges (Ferderer, 2008; Michie, 2000; Sobel, 1965, 1972). Although promoters of such technology overpromised the ability of technology to decouple markets from space, these networks demonstrated alternative modes of organisation and coordination that accelerated the flow of information between financial centres and their peripheries (see Naisbitt, 1987).[2] The popularised concept of decentralisation thereby captured the geographic shift in scale from centralised floor-based exchanges to national information technology networks.

In 1971, the National Association of Securities Dealers (NASD) used nascent computer networking technology to formalise the geographically decentralised OTC market (Abolafia, 1996; Adamson, 2016; NASD, 1971a). The National Association of Securities Automated Quotation system (NASDAQ) was designed to distribute securities pricing information to brokers across the United States (Goodyear, 1972; NASD, 1971a; Schwartz et al., 1972). The original design documentation specified 'A flat cost to all subscribers … regardless of geographic distance from the central computer' (NASD, 1965, p. 6). The central computer enabled the market to be geographically decentralised by ensuring equal costs regardless of proximity to the centre. As William G. McGowan, an influential board member of the NASD, described it: NASDAQ was a 'screen based, decentralized electronic market' (McGowan, 1989, p. 2). Although the computer mainframe was centred in Trumbull, Connecticut, it afforded a nationwide 'electronic trading floor' network that was not constrained by the walls surrounding an existing stock exchange floor (Greer, 1971; NASDAQ, 1972b). Instead of an exchange floor, NASDAQ operated a telecommunication network using 'more than 30,000 miles of high-speed communications circuitry' that connected 1000 computer terminals in

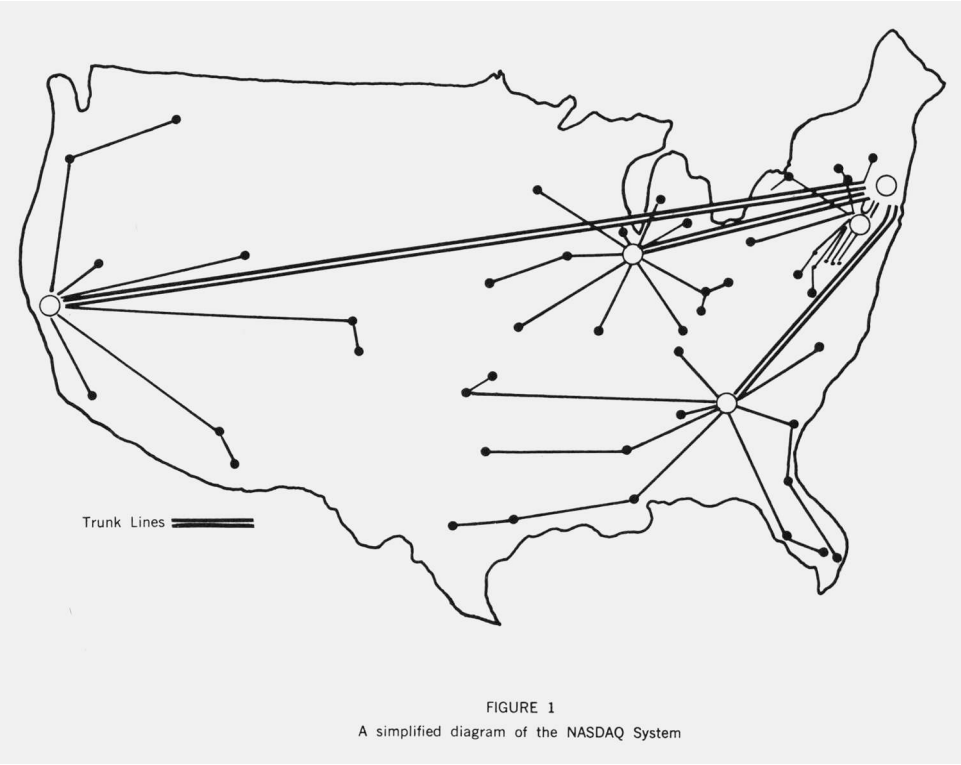


Figure 1. NASD's depiction of the NASDAQ System, 1976. Source: NASD, 1976, p. 22. Rotated and contrast-adjusted for legiblity.[1]

brokerage offices nationwide through centres in New York, Chicago, San Francisco and Atlanta (Beltz, 1972; Goodyear, 1972, p. 42; Schwartz et al., 1972). The spatially decentralised structure of the early NASDAQ system was displayed in network diagrams (see Figure 1), which show networks of peripheral nodes connected to regional hubs (Mills, 1972, p. 1200; NASD, 1976, p. 22).

3.2. Decentralising market making

Throughout the 1970s the concept of decentralisation, as applied to financial markets, developed new connotations. In addition to the geographic application of the term, the concept gained an organisational valence which opposed decentralised competitive market structures to centralised and monopolistic ones. This sense of the term was connected more strongly with the Hayekian notion of a decentralised competitive market that opposed central planning. NASDAQ promoted itself as not only decentralising the geography of financial markets, but also decentralising their organisational structure. William McGowan, a prominent NASD board member, characterised the Nasdaq system as 'a decentralized network of competing market makers' (McGowan, 1991, p. 12). Here, decentralisation refers not to the spatial structure of NASDAQ but rather the organisational structure of the market.

For brokers in the 1970s, NASDAQ's competitive market making system presented a stark contrast to the NYSE's centralised system of specialists. Unlike NASDAQ, the NYSE employed intermediaries in the organisational structure of the market called specialists whose function was to match buy and sell orders and provide liquidity when necessary (Sobel, 1975, p. 16). In the NYSE system, this role was highly centralised: specialists held monopoly positions as the sole market makers for their assigned securities (Abolafia, 1996). NASDAQ's market makers played a similar function as specialists. Like specialists, market makers continuously quote both buy and sell prices for securities and create liquidity by standing ready to trade (MacKenzie & Pardo-Guerra, 2014, p. 159). However, unlike the NYSE's system of singular specialists who had monopolies on specific stocks, multiple market makers could compete to provide competitive prices for the same security (Editors, 1971, p. 40; NASDAQ, 1972a; Sobel, 1975). Thus, the NASDAQ system came to be described as a *decentralised* approach to market making:

> [T]he NASDAQ system maintains competitive 'market-makers'. These are firms committed to announcing at all times prices at which they will buy or sell a minimum number of shares of a stock. Decentralized market forces thus ensure that prices will move quickly and accurately to reflect all available information. (Fischel, 1986, p. 14)

Here, the emphasis on 'Decentralized market forces' distinguishes NASDAQ from the previous model, which was both spatially centralised around a physical exchange floor and organisationally centralised around specialists. NASDAQ's system was designed to promote disintermediation and reduce the influence of any one specialist's market-making power (Loomis et al., 1975). In this sense, NASDAQ's system of decentralised market makers was more closely aligned with the Hayekian principle of decentralised planning (Hayek, 1945).

Furthermore, NASDAQ's competitive approach to market making is embodied not merely in institutional rules, but in its technical architecture. The system's early technical specification stated that 'dealers can use the equipment to negotiate transactions with the market maker of their choice through the computer' (NASD, 1965, p. 6). At an infrastructural level, this historical form of 'decentralisation' was enabled by a 'user-driven' network of brokers and market makers (Beltz, 1972, p. 1009; Mills, 1972, p. 1197). Whereas the NYSE concentrated market-making authority in specialists who held monopolies over individual securities, NASDAQ's system permitted any authorised firm to disseminate quotations to the broader OTC trading network (Beltz, 1972, p. 1010). The capacity for direct negotiation with market makers of choice meant that NASDAQ's technical architecture pre-empted the emergence of a singular mediating authority for stock transactions.

The popularity of NASDAQ's system challenged the assumptions that geographic centralisation and centralised market making were necessary for the functioning of financial markets by providing a model for how liquidity could be mobilised at a national scale through a combination of technological and competitive mechanisms (Armour, 1972, p. 13). Following the success of NASDAQ, regulators and industry leaders realised a similar system could be applied to the structure of the broader capital market system, whereby each market venue could function as a node in the network of competing financial markets (Loomis, 1974, p. 6; Marshall, 1971, p. 13). However, the relationships between centralisation and decentralisation in markets created a paradox: even if geographical decentralisation could be achieved, it was achieved through the centralisation of computer systems. Similarly, decentralised market making was possible within the otherwise centralised structure of the rules and technical systems maintained by NASDAQ. Though this paradox persisted, the technical possibility of geographic decentralisation and decentralised market making opened up the question of what market infrastructure benefits from centralisation or decentralisation.

4. De/centralising the capital market industry

The popularity of NASDAQ's approach to competitive and networked market structure had lasting influence on the organisation of the US capital markets industry as a whole. Prior to NASDAQ, industry leaders from the NYSE and federal regulators saw centralisation and top-down state regulation as the two primary tools to rid capital markets of organisational faults (Martin, 1971; SEC, 1972). The novel use of networked computing technology by NASDAQ afforded an alternative solution to policy makers (Loomis, 1974). Beginning in the 1970s, policy makers and financial industry leaders increasingly advocated for technological solutions and competition, rather than regulation or centralisation, as means to discipline the national market.

4.1. Centralisation and regulation as remedies to fragmentation

Industry leaders from the NYSE and the SEC initially agreed that a central market system which leveraged centralised market infrastructure and strong, unified, federal regulations would be beneficial for US financial markets (Kennedy, 2017; Pardo-Guerra, 2019). As the dominant stock exchange in the United States, the president of the NYSE welcomed regulation so long as regulations were applied evenly to all exchanges (Needham, 1972). In the 1970s, representatives of the NYSE objected to the lack of regulatory harmony and what they characterised as unfair competition between stock exchanges (Martin, 1971; Sobel, 1975). Throughout the 1960s, the NYSE increasingly lost order flow to relatively unregulated regional exchanges

and the OTC market which provided alternative markets for NYSE-listed securities at lower prices (Sobel, 1975, pp. 301–312). Unlike registered exchanges, which were beholden to SEC rules and reporting requirements, the OTC market operated under the self-regulatory authority of the NASD, with different and less stringent rules (McGowan, 1974; NASD, 1970, 1971a; Sobel, 1975, p. 24). The inter-market competition between exchanges and the OTC created an environment where trading practices, reporting requirements and prices became highly variegated – leading stock market observers to characterise the industry as fragmented (Blume, 1993; Martin, 1971; Weeden, 2010). The NYSE was particularly opposed to OTC markets that traded NYSE securities because, 'Not only would they drain business from the central market and so lessen liquidity, but the operations were transacted under the cover of anonymity and not in the open atmosphere the Exchange prided itself upon' (Sobel, 1975, p. 340). In the face of these concerns over fragmentation, the leading position among representatives of the NYSE and the SEC was to eliminate fragmentation through the imposition of centralised market structure and unified federal regulations.

Centralisation was held up as a key remedy for the problem of fragmentation (Martin, 1971; Sobel, 1975, p. 352). As reflected in NYSE President James Needham's public speeches and reports such as the Martin Report, the NYSE advocated for a central market system that would centralise trading on exchanges, prohibiting third market transactions and confining all trading in listed securities to the exchanges (Harman, 1978; Martin, 1971; Needham, 1972). Advocates of the central market system believed it would strengthen the US capital market industry by deepening liquidity and ensuring that all securities were traded under the same rules. Notably, the means by which the NYSE sought to diminish fragmentation was through regulation and centralisation (Martin, 1971, p. 11; Needham, 1972, pp. 3–5).

The Securities and Exchange Commission (SEC) initially agreed that a central market system which leveraged centralised market infrastructure and regulations would be the optimal solution to problems of market fragmentation (Wall Street Journal Staff Reporter, 1971b). Although the SEC dissented to the NYSE's proposal of barring the OTC market from participation, the SEC agreed that a centralised market where all orders converge in one place, would ensure the most competitive prices for securities (Colby et al., 1985; Pardo-Guerra, 2019, p. 266). The SEC defined the 'central market system' as 'a system of communications by which the various elements of the marketplace, be they exchanges or over-the-counter markets, are tied together' (SEC, 1972, p. 5287). For SEC regulators, the aim of such a system was to 'internalize within that system, and make visible to the investing public, the competition which now takes place among the separate exchange markets and between all of them and the third market' (SEC, 1972, p. 5287). Rather than advocating for a capital markets industry characterised by competition within separate exchanges, SEC regulators advocated for a market where competition should be incorporated into the policies, architectures and technologies of a centralised system. Thus, while the commission maintained a commitment to the principle and ideal of competition, it shifted away from the tendency 'to favor competing but separate markets' and toward a system that '… could foster competition within a central market' (SEC, 1972, pp. 5286–5287). The SEC thus sought to maximise competition within a single market by accepting reduced competition between markets. This view found its clearest expression in the 1971 Williams hearings, where the chairman of Merrill Lynch insisted that an investor 'should be able to come to the central place where all bids and offers for that particular stock are congregated', objecting that trading was instead dispersed across New York, the Pacific coast and a 'nebulous' third market (Kennedy, 2017, p. 905). By 1971, the chairman of the SEC was prepared to ratify the Central Market System in official policy (Robards, 1971b).

Expanding on Martin's, 1971 Report to the Board, commissioner Loomis envisioned an electronic network where computer technology would rationalise the market – an electronic network that could overcome the fragmented and regionally disparate marketplaces of the 1960s and early 1970s. In 1971, when James Needham was an SEC Commissioner, he was sceptical of the idea of a fragmented national market system composed of autonomous and competing markets. He remarked 'isn't the center we're aiming at a center where all orders converge?' (Wall Street Journal Staff Reporter, 1971c, p. 8). In these formulations, both the SEC and the NYSE took as self-evident that competitive prices presuppose a single point of convergence: that competition requires, as its precondition, a centralised site where prices are aggregated,

Text for Footnote 1

standardised and made commensurate. What a Hayekian account treats as the already-given existence of 'the market', these actors understood as something that had to be deliberately built.

This sentiment was echoed in the findings of the Advisory Committee on The Implementation of a Central Market System. When the committee met in April of 1974, the members agreed that the 'most efficient and effective structure' would involve a single 'National Securities Exchange' that would be created 'through the merger of presently existing exchanges … ' (NYSE, 1975, pp. 18–19). Regulators saw the central market system as a means of harmonising diverging expectations and norms regarding listings, settlement and clearing consolidating competition and standardising regulation (SEC, 1972, p. 5287).

In the 1960s and early 1970s, the dominant view among industry leaders and regulators was one that valued centralisation and unified federal regulation as an efficient means of fostering fair competition and deepening liquidity in US capital markets (Martin, 1971; Needham, 1972; SEC, 1972). Far from being centralised however, these industry leaders were concerned that the industry remained largely fragmented (Wall Street Journal Staff Reporter, 1971a, p. 16). It was in the face of this fragmentation that centralisation and regulation were proposed as viable solutions (SEC, 1972, pp. 5286–5287). However, despite discursive appraisals of centralisation, the historic process of centralisation was highly contested. I show, below, law makers ultimately preserved the fragmented regulatory landscape while promoting technology as means of enabling competition between differently regulated market venues.

4.2. Contesting centralisation

The contested effort to create a central market system demonstrates that centralisation was a contingent and politicised process. Despite the initial alignment between the NYSE and the SEC on the prospects of centralisation, the proposal for a central market system received harsh criticism from competing industry representatives and observers who maintained that centralisation would be detrimental to the dynamics of the capital market industry (Folk, 1971; Robards, 1971a; Tobin, 1971). These critics argued that centralisation would hinder competition between markets. It was in the context of this debate that *networks* were championed as a potential solution to trade-offs between fragmentation and centralisation (Folk, 1971; Loomis, 1974). NASDAQ's electronic network was circulated as a model for how a national market system could circumvent centralisation (Loomis et al., 1975). Critics of centralisation focused on how the NASDAQ market leveraged computer automation technology to create a network of brokers, without routing orders to a single centralised exchange floor (Loomis et al., 1975, p. 292). As a chief engineer of the NASDAQ network put it, 'The NASDAQ System, with its flexibility and nation-wide communication complex, has stirred the imagination of the entire brokerage industry' (Beltz, 1972, p. 1015). NASDAQ's use of novel computer networking technology changed the attitudes among regulators and lawmakers who began to doubt the NYSE's arguments in favour of a centralised market (Loomis, 1974). The resistance to and ultimate rejection of the central market system demonstrates that centralisation was not a taken for granted characteristic of these traditional financial institutions, but rather a deliberate organisational choice that faced significant opposition from those who valued inter-market competition over operational efficiency.

The project of centralisation was highly politicised as it raised questions of monopoly power, competition and market concentration. Leaders of competing exchanges, such as the president of the Midwest Stock Exchange, Michael E. Tobin (1971), criticised Martin's plan for undermining American capitalist values:

> Because of the strategic importance of the securities industry to the operation of the free enterprise-capitalistic system, control of this industry cannot be permitted to be concentrated in the hands of a few persons or firms … Such a concentration of power could not be tolerated even on the grounds of efficiency. (Tobin, 1971, p. B7)

The argument that the efficiencies of centralisation do not justify the broader political-economic costs of monopolisation was shared by other industry representatives, financial analysts and academics. Donald E. Farrar, a financial analyst for the New York Times, argued that by centralising all orders, the NYSE would have an effective monopoly on the industry and that this institutionalised control would reintroduce barriers to competition (Farrar, 1971). Similarly, the legal scholar Ernest Folk III, criticised the plan for elevating the NYSE's interest above the interests of other securities markets (Folk, 1971, p. 1375). For Tobin,

Farrar and Folk, the competition worth protecting ran between markets, which a single central exchange would diminish however well it ordered competition within itself.

Economists, especially those associated with the still burgeoning discourse of neoliberalism such as Milton Friedman and George Stigler, endorsed a one-and-a-half-page letter that critiqued the proposed central market system for failing to consider how a NYSE led monopoly may distort the market (Robards, 1971a). In Spring of 1971, just months before the Martin Report, George Stigler published his influential article on The Theory of Economic Regulation which proposed that regulated companies tend to capture the regulatory apparatus and use it to further their own interests (Stigler, 1971). In this context, Stigler's theoretical framework lent academic legitimacy to fears that the NYSE would capture and manipulate any centralised regulatory structure, reinforcing wider industry concerns about concentrated market power. A common thread among the criticisms of the Central Market System was that it threatened an American brand of competitive market capitalism. In opposition to centralisation, these critics defended the 'American commitment to the benefits of competition' (Folk, 1971, p. 1346). Rather than being a taken for granted feature of these traditional financial institutions, these debates indicate how centralisation was deeply politicised.

What made the anti-centralisation position actionable was a technological capacity that had not previously existed: NASDAQ's network technology demonstrated that price formation, once achievable only by the physical concentration of buyers and sellers on the exchange floor, could now be performed computationally, across a network, without a single floor. Though neoliberal policies were not yet popularised in the early 1970s, these nascent liberal critiques of the central market system became persuasive to regulators just as the alternatives to a central market system became buildable. As critics articulated their opposition to centralisation through appeals to American market ideals, NASDAQ was positioned as a technological embodiment of these competitive principles. NASDAQ represented more than just another competitor to the NYSE; it demonstrated how computer networks could reorganise market structure in alignment with American aspirations for competitive capitalism (Folk, 1971; Loomis, 1974). The timing was significant: in 1971, as the capital market debate intensified, the NASDAQ system began its operation (Armour, 1971; NASD, 1971b).

4.3. Technological shifts in regulatory discourse

NASDAQ's automated quotation system captured public imagination. Advertisements depicted the computer system as a machine capable of transforming the chaotic throng of the floor into data discoverable at the touch of a button (NASD, 1972, p. 13). In the first two years after NASDAQ was introduced the total volume of shares traded on NASDAQ reached 1.7 billion; about half of the four billion shares traded on the NYSE and over two times the 770 million shares traded on AMEX, making NASDAQ the second largest securities market in the US (NASD, 1974, p. 7).

The success of NASDAQ's technology induced a shift in regulatory discourse away from questions of fair regulation toward questions of optimal market design and infrastructure (Ketchum, 2008, p. 3). In this new regulatory paradigm, regulators began to trust that competitive market structures, not universal legal constraints, would create pragmatic solutions to problems of monopolisation, consolidation and centralisation (Ketchum, 2008; Loomis, 1974). The SEC commissioner Philip A. Loomis Jr. clearly articulated this change in official position. After the establishment of NASDAQ, Loomis argued that regulations are only effective at restraining specialists 'from doing what they ought not to have done' but regulations are ineffective when it comes to preventing them 'from leaving undone what they ought to have done' (Loomis, 1974, p. 6). In light of this view, regulators began to disavow punitive regulation because, unlike competition, it lacked a mechanism to incentivise market participants. In opposition to the SEC's previous avowal of unified federal regulation, the commissioner argued that 'The time has come to rely more on the forces of competition to discipline market maker's performance' (Loomis, 1974, p. 6). Loomis's reformulation marks how the Hayekian notion of decentralisation entered SEC regulatory discourse. Under this formulation, competition is not defended on the basis of universal morals or principles such as fairness or equality, but rather as a pragmatic mechanism that processes information and disciplines conduct more effectively than rules or a central authority.

Rather than relying on regulations, the market forces of competition were now seen as an alternative and more powerful remedy for regulation's ineffectiveness. This position was echoed by SEC commissioner A. A. Sommer (1975) who shared his view:

> Historically the Commission had been told to regulate existing entities and systems, to oversee them, to moderate and modulate their conduct when necessary in the public interest. Now the Commission is being told to take affirmative measures to bring into existence something new, a national market system. (p. 13)

Rather than overseeing existing systems to ensure that they functioned in the public interest, the SEC's role was to create 'affirmative measures' that incentivise the creation of a new system.

In addition to changing positions on the effectiveness of punitive regulation, SEC commissioners and law makers shifted their emphasis away from centralisation as a solution to fragmentation. The technical possibility of a decentralised network, embodied in NASDAQ's design, inspired regulators to consider a national market system as an alternative to the central market system. Crucially, NASDAQ's computerised network technology provided an alternative model to spatial centralisation and top-down regulation. After the rise of NASDAQ, the opinions of SEC commissioners began to shift toward a more fragmented and competitive national market system. Whereas commissioner Loomis had previously dismissed alternatives to centralised markets as overly complex and technically infeasible, NASDAQ demonstrated to him that the problems facing a competitive inter-market structure were merely technical and not intractable (Loomis, 1974; Wall Street Journal Staff Reporter, 1971c). In his 1974 speech, the commissioner outlined a 'practicable alternative' to a spatially and institutionally centralised market system (Loomis, 1974). 'It is no longer necessary', he said, 'for lack of any other technically feasible method, to bring all orders together on one floor' (Loomis, 1974, p. 5). This was a significant shift in opinion. Whereas the idea of a floor-less exchange was previously unimaginable, 'The NASDAQ system provides a model as to how this can work, at least mechanically' (Loomis, 1974, p. 2). NASDAQ's networked structure thus served as a template for how a nation-wide market system could address problems of fragmentation without resorting to a spatially and institutionally centralised system.

Furthermore, unlike Martin's vision of a centralised regulated market which was designed to rid the market of fragmentation, Loomis envisioned a competitive market system that could take advantage of fragmentation. Whereas Martin stressed that fragmentation produced unfair market conditions that required regulatory solutions, Loomis (1974) began to see a potential good in fragmentation. In line with arguments from proponents of the OTC (see Armour, 1971, p. 3), Loomis (1974) reinterpreted fragmentation in the market as a sign that the capital market industry – the market for financial markets – sought to be more competitive. From this new vantage point, fragmentation was not an underlying problem to be solved by centralisation and regulation; it was a symptom of demand for competition stemming from institutional investors trying to 'avoid or evade the fixed commission' imposed on securities by the NYSE (Loomis, 1974, p. 5). Thus, as Folk articulated in 1971, the 'real issue' is not necessarily how to rid fragmentation, but 'whether in this case "fragmentation" produces good or bad results' (Folk, 1971, p. 1315). In this view, fragmentation was not a failure caused by the lack of consistent regulation, but rather the market's solution to the problem of high fixed commission costs imposed by the NYSE (Hamilton, 1987).

Following this shift in perspective, market architects reasoned that, for fragmentation to spur competition in the market for financial markets, 'we should put all of the trades on one consolidated tape … akin to what was developing in the NASDAQ market' (Weeden, 2010, p. 41). In the design documents that NASDAQ shared in congressional hearings regarding the National Market System, NASDAQ engineers proposed a computerised network that would list the prices of securities offered on different competing exchanges, just as it had already done in its system of multiple competing market makers (NASD, 1976, p. 24). The networked design of NASDAQ 'offered a solution to the problem of how, despite fragmented markets, an investor and the broker representing him could rapidly and cheaply be put on the road to the best market for executing his order' (Schmidt, 1977). Had network technology not existed, depth of competition could only be achieved by concentrating trading activity in one centralised geographic location. In the technological imaginary of a National Market System, the whole country could be mobilised to increase the depth of the market using computer networks. Owing to networked technologies, regulators

began to believe that 'All of the market making capacity of the country needs to be mobilised to preserve liquidity and depth' (Loomis, 1974, p. 6).

While the vision of a centralised market initially had support from law makers and regulators, it was ultimately rejected in favour of a less centralised national market system whereby US financial exchanges would compete with one another in what would later be called the market for markets (R. A. Schwartz, 1998). The imaginary of networked technology fundamentally altered the regulatory discourse around market structure. Rather than seeing centralisation as the only path to efficiency, regulators began viewing networked inter-market competition as a means to achieve policy goals, reflecting broader post-war shifts in political-economic thinking regarding markets and regulatory control (Harvey, 1989). Loomis' reversal, alongside the interventions of Stigler and Friedman thus signal the emergence of a 'competition' as discipline at the cusp between Keynesianism and what, by the end of the decade, would become consolidated as Neoliberalism under the policies of Thatcher and Reagan.

4.4. Displaced de/centralisation

In practice the debate over the centralisation of the capital market industry was not over whether markets required centralisation; it was over where and how that centralisation should be instituted. Although the SEC's changing position was met with resistance, the ultimate outcome was an attempt to balance the efficiency of centralised market utilities and the market discipline afforded by competing exchanges. While NYSE initially resisted the competitive reforms favoured by the SEC, over time both approaches converged toward a more integrated, competitive and technologically advanced National Market System, though with ongoing debate over the optimal balance between centralisation and competition (Harman, 1978).

With the Securities Acts Amendments of 1975, Congress voted for a *National* Market System in opposition to the previously proposed *Central* Market System (Colby et al., 1985; Kennedy, 2017). The distinction in terminology is important, as the legislation adopted the free market principles of competition between exchanges to construct a connected but competitive financial market at the scale of the nation such that the 'National Market System' would 'evolve through the interplay of competitive forces as unnecessary regulatory restrictions are removed' (H. Rept, 1975, p. 3). Just as NASDAQ had previously produced a decentralised network of broker-dealers through a centralised computer system, the Securities Acts Amendments of 1975 called for the creation of both centralising and competitive components including computer-mediated 'communication systems' for consolidating price information, centralising transaction clearing and interconnecting securities exchanges (H. Rept, 1975, p. 93). These legally mandated infrastructures would aggregate data across competing exchanges, creating a competitive network at a national scale. However, the policy makers and regulators only provided a legal framework, without stipulating the specific components, technologies, or institutions comprising the system (Kennedy, 2017, p. 890).

In the void left by the lack of regulatory specification, the ensuing debate concerning the structure of the National Market System produced a hybrid system that combined features of centralisation and decentralisation. The NYSE and the regional exchanges constructed an Intermarket Trading System (ITS). As Kennedy (2017) showed, proponents of a Composite Limit Order Book (CLOB) pressed for a 'Hard CLOB' of total centralisation whose explicit success criterion was that intermarket arbitrage become impossible, while the NYSE's Intermarket Trading System offered a looser federalism of connected but decentralised venues. This system was considerably different than the centralised market system first imagined by Martin. As Blume et al. (1993) characterised it, 'under the Intermarket Trading System, the execution system is decentralized: orders are executed at the various exchanges around the country' (p. 178). Furthermore, the system did not integrate the OTC market until 1981 when NASDAQ's Computer Assisted Execution System (CAES) was connected to the NYSE's ITS (NASD, 1982). Thus, in contrast to the SEC's original vision for a centralised market system where all orders interact in one centralised order book before execution, the intermarket system did not prevent the fragmentation of prices across different market venues (p. 178).

Centralisation, however, was not eliminated; rather it was relocated to various infrastructural components, including a consolidated tape to record the transactions from all exchanges, as well as a centralised securities depository to handle post-trade settlement so that the execution and market making could be

distributed across competing venues (Kennedy, 2017; Pardo-Guerra, 2019). As Kennedy (2017) documented, the NYSE's technology subsidiary SIAC expanded through the early 1970s into the *de facto* national data processor for multiple exchanges. This account aligns with Pardo-Guerra's (2019) observation that competitive markets rest on what he calls 'infrastructures of infrastructures', and that contemporary automation is 'unthinkable without the consolidation and standardisation of data feeds from trading sites to market users' (p. 304); he notes, too, that the National Market System 'required a centralized clearing body based on the dematerialization of paper certificates' (p. 304). As Golumbia argues, 'Computerization is always going to promote centralization even as it promotes decentralization – often in one and the same motion' (Golumbia & Simanowski, 2016).

The analysis of debate surrounding the Central Market System corroborates the view in social studies of finance literature that markets – and their translation to computerised systems – require the construction of centralising components responsible for the aggregation, standardisation of goods, information and rules that form the conditions of possibility for competition. However, the unstable positions of state regulators and industrial actors suggest the question of what to centralise, and what to make competitive was the subject of a political struggle between factions of the capital market industry. Although, at this particular historical conjuncture analysed here, the consolidated tape and central depository were the historical resolution that the contest ultimately settled on, this particular format for intermarket competition was not inevitable or necessary: a hard CLOB would have centralised the capital market system more fully, thus enabling more transparent and competitive prices for securities but at the cost of preventing competition between exchanges. The Intermarket Trading System that was produced preserved inter-market competition at the cost of fragmenting the price mechanism. The requirement, that some components of market system had to be centralised to enhance competition constrained the actors; but how that requirement was translated into material infrastructure was ultimately the product of political contestation between factions of the capital market industry.

5. Conclusion

As I argue in this article, geographic decentralisation shifted the locus of centralisation from regionally situated marketplaces to shared national market infrastructures and I show how the creation of these systems was couched in a struggle between centralising and decentralising tendencies. The contested history of financial centralisation thus reveals that levels of fragmentation, centralisation and decentralisation have coexisted, often complementing one another. As I have argued, in the history of twentieth century US financial markets, the concept of decentralisation was not originally opposed to the institutional centralisation of financial markets or the consolidation of power. Rather the term was first used to describe the geographic decentralisation of the OTC market. However, owing to the merging of spatially decentralised markets and structurally decentralised markets under NASDAQ's competitive multiple market maker system, decentralisation carried both meanings. Unlike fragmentation, which carried negative connotations, the concept of decentralisation helped connect competitive market making, computerisation and the removal of intermediaries into a coherent and defensible position among industry leaders. During the 1970s, the technological imaginary of computer networks supported opposition to centralisation and aided efforts to use competitive markets to discipline the market.

This historical period demonstrates that centralisation was contested, politicised and contingent. Prior to the 1970s, traditional financial institutions within the capital market industry were fragmented and characterised by competing venues and uneven regulations. In the face of fragmentation, dominant institutions attempted to construct centralised systems. However, the success of these projects was not guaranteed. The failure to produce a centralised market for financial securities demonstrates that centralisation was not taken for granted as a defining characteristic of traditional finance; it was actively produced through the decisions and actions of political and economic actors. The popular opposition of decentralised finance to traditional finance obscures the variety of organisational forms present in both historic financial systems. Rather than radically opposed to one another, traditional finance was marked by combined forms of centralisation and decentralisation born out of ongoing contests over market power and consolidation.

Notes

1. NASDAQ lacks a public archive open to researchers and the media team at NASDAQ did not respond to inquiries regarding whether private archives exist. The NASD, which previously owned and managed the NASDAQ system before NASDAQ separated and become a publicly traded company, has been dissolved and correspondences with representatives of NASD's successor FINRA were unaware of the location of any remaining archival records.
2. Geographic decentralisation does not inherently spread information evenly and often intensifies uneven geographies of finance (Sassen, 1991; Wójcik, 2011).

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