

**The Politics of Fragmentation: Liberalism, Market Equality,
and the Technological Re-configuration of American Finance**

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Abstract

Algorithmic and high frequency trading are predicated on the technological, spatial and organizational fragmentation of financial markets. Where does such fragmentation come from? In this paper we examine the history of American financial infrastructures to show how political philosophies shaped the architecture of markets. Specifically, we explore the history of a failed initiative, the Consolidated Limit Order Book (CLOB), as a means for studying three distinct liberal conceptions that surrounded public debates on markets, equality and technology in American finance. The analysis documents fragmentation as the result of a two-phased ideational transition fuelled by regulatory attempts to achieve a compromise between contrasting political philosophies on the role of financial markets in social life.

Keywords: Finance, Fragmentation, Equality, Infrastructures, Neoliberalism

The Politics of Fragmentation: Liberalism, Market Equality, and the Technological Re-configuration of American Finance

On 6 May 2010, the Dow Jones Industrial Average suffered one of its largest drops in history, plummeting 998.5 points in little less than an hour.¹ The magnitude of the drop was impressive: at its lowest point, the market had lost more than a trillion dollars in capitalization—over 9.2% of its opening value. More notable, perhaps, was the speed at which markets fell: the bulk of the losses occurred during a 20 minute period after 2:45 Eastern Standard Time when the DJIA dropped 7% in a frantic, seemingly inexorable plunge. (Within an hour, the index had recovered most of its losses.) The events of 6 May 2010 were neither ‘black’ nor ‘great’; they were simply fast. First called the Crash of 2.45, they ultimately became known as the ‘flash crash’.

In the hours and days following the flash crash, market participants and regulators sought causes. An initial explanation was typically macroeconomic: the Greek sovereign debt crisis, which made headlines that morning, catalyzed the fall of an already distressed market. The speed and intensity of the drop, however, were at odds with economic wisdom. On that afternoon, markets neither reflected fundamentals nor animal spirits: the flash crash looked more like a technical glitch than a run on the market. Indeed, commentators soon attributed the event to the actions of algorithmic trading in general and so-called high frequency trading in particular.²

After a detailed investigation, the American stock market regulator, the Securities and Exchange Commission, SEC, concluded that the trigger of the crash was not high-frequency traders (HFT) but an algorithm acting on behalf of a big institutional investor.³ HFTs acted understandably: some profited from the turmoil; others withdrew from the market, and as they exited, the reduced liquidity hugely exacerbated price movements. The flash crash was thus a consequence of technical interconnectedness, a stark reminder of finance's intimate and increasing dependence on information technologies. Without the expansive networks of trading screens, algorithms, microwave relays, fiber optic cables, and electronic matching engines that populate stock markets today, the flash crash of 2010 would likely never have occurred.⁴

For some social and political analysts, the flash crash was more than simply a technological disaster. It was, critically, symptomatic of neoliberalism's grip on modern societies. Algorithmic trading, some argue, is the technological epitome of financialization,⁵ making "the microsecond trade [...] the timescape of neoliberal Capitalism."⁶ For others, the flash crash was the concrete manifestation of a neoliberal 'noösphere,'⁷ "a partially autonomous realm in which informational algorithms interact with one another in ways that often defy human understanding, prediction or control." And owing to its technical opacity, yet other scholars represent algorithmic trading as neoliberal chimeras, private actions that elude "national and regional agencies" making them difficult "to effectively track or regulate."⁸ For these, finance's relation with technology, exemplified most starkly in algorithmic and high frequency trading, is entirely modulated by the rise of neoliberal ideology.

This paper addresses the political history of algorithmic trading by asking the question of how stock markets came to be complex, interconnected technological domains. With this, it questions and expands upon conventional (mostly economic) accounts of financial automation. To the question of where algorithmic trading comes from and how it was shaped by politics, economic theory stresses rational factors as driving market change. For economists of financial innovation, novel market developments are consequences of strategic decisions taken by agents dealing with extant institutional and regulatory constraints; driven by rational decision-making, financial innovation leads to efficient forms of capital allocation, pricing, and a more robust sharing of risk across the marketplace in the context of sub-optimal institutional designs.⁹

Some forms of algorithmic trading are particularly dependent on at least one of these institutional constraints: the growth of market fragmentation in late twentieth-century finance. At the time of writing, for instance, the market for Google's stock was distributed throughout at least eleven US trading venues and seven European exchanges, not including dark pools, crossing networks and over-the-counter transactions.¹⁰ To the question of how much is Google worth there were on that day 18 possible answers, one for each trading venue. At least one algorithmic trading strategy thrives from continued price differentials across multiple marketplaces: 'latency arbitrage', which in the views of some market participants constitutes an unfair advantage and the source of "(almost) risk free arbitrage opportunities."¹¹ In order to situate this and other practices, it is useful to understand politics not as an external boundary condition but as an on-the-ground force

shaping the institutions and infrastructures of markets from within. Algorithmic trading is certainly shaped by the ‘external’ factors of technology and regulation; but its historical trajectories depend, too, on ‘internal’ political contests that constructed American stock markets as spatially, technologically and organizationally fragmented domains.

How to understand the trajectories of fragmentation? Here, we recognize fragmentation as the result of an ideational re-embedding of financial markets across distinct moral and political evaluation frameworks.¹² What wrought fragmentation of America’s financial infrastructures was not ‘simply’ the availability of technology or the diverging interests of public and private institutions: more profoundly, fragmented markets are outcomes of struggles and compromises forged between different political philosophies that posit fundamentally contrasting conceptions of equality, fairness and efficiency.

To study this political history, we focus on the development and eventual failure of a market infrastructure, the Consolidated Limit Order Book (CLOB). Proposed in the late 1960s as a technical solution to problems of fairness and equality in US stock markets, CLOB was an ambitious plan to create a single central trading mechanism. Regulators and market participants supported CLOB well into the 1980s, justifying the project through a discourse echoing classical liberal thinkers who stressed equality of welfare as cornerstone of fairness and social organization. In the late 1980s and early 1990s, however, the discourse around market centralization changed, adopting a logic that combined high-liberal ideals of equality of resources with libertarian calls for independence, competition and democratization. With this transition, support for a single

physical CLOB dissolved. In place stood the fragmented marketplace on which algorithmic trading flourished.

Finance, politics and market technologies

Bruce Carruthers recently wrote of the importance for sociology of studying finance. Despite the relative dearth of research on finance within the broader literature, argues Carruthers, “in some fashion or other, finance enters into many sociological topics.”¹³ Indeed, Carruthers is right in observing that “finance is seldom more than a step away from core sociological concerns,” standing as a central element in the politics and organization of modern societies.¹⁴

If our purpose is to speak of the political fabric of American finance, a starting point should be the sociological literature on markets and politics.¹⁵ While existing research certainly highlights the imbrications of finance and formal politics, it focuses on macro-institutional¹⁶ processes within which, paraphrasing Weber, it seeks to discern the mechanisms that social actors employ to modify extant distributions of power as a “means in serving other aims.”¹⁷ Consequently, in the relevant literature, finance is an almost instrumental means oriented towards broader socio-political ends.

Here, we understand financial markets as the result of local, morally embedded contests between agents advocating different political philosophies. Instead of concentrating on larger institutional struggles, we focus on how changing political philosophies of moral

worth legitimized and shaped the course of markets and their infrastructures. This approach not only stresses politics and morals as endogenous to the marketplace,¹⁸ but also sees financial technologies as sites for debates about fairness, justice and morality that echoed broader concerns within twentieth century American society.

Sociological work on financial technologies has been prolific in the past decade, particularly in social studies of finance, a variegated literature at the intersection of economic sociology, anthropology, political science, and science and technology studies. Echoing economic sociology, social studies of finance challenges both atomistic models of human action and the abstraction of markets beyond society.¹⁹ Yet following science and technology studies, social studies of finance recognize the constitutive role of technology in social life.²⁰ Social studies of finance offer a distinct contribution to the study of markets in society: building upon existing research, the field stresses the materiality of markets, apprehended through their physicality, corporeality and technicality.²¹

Despite its contributions, critics of social studies of finance have stressed the literature's perceived inability to deal with politics and ideologies. For Philip Mirowski, the field's theoretical commitment to science and technology studies (and, in particular, to actor-network theory) means that the literature seems "uninterested in the details of how [social] order is wrought."²² The analysis of how interests configure social institutions is hence overshadowed by discussions on the technicalities of economics and market devices, putting "aside the question of critique and political debate on the economy."²³

Legal anthropologist Annelise Riles agrees: the “now-dominant sociotechnical approach to markets gives us an insufficiently rich account of the nature of politics, of the intermingling of fates, within a market form shaped” by other expertise, failing to understand the market as a site of “purposeful government of self and others.”²⁴

As a claim on the constitution of modernity, a robust sociology of finance would thus have to deal with both the intricate technicalities of markets and larger discussions of what Riles calls the *explicit*²⁵ politics of society. What is required, then, is a theoretical bridge between literatures: on the one hand, social studies of finance and its emphasis on materiality, instruments and markets; on the other hand, established work within the historical sociology of finance, with its sensibility towards the dynamics of political institutions.

The question is, then, whether social studies of finance can *do* politics? Arguably, seminal work in the social shaping of technology provides initial inspiration.²⁶ Built on historical studies of the evolution of artifacts, social shaping of technology refutes simplistic readings of technical change as a process driven by inherent technological, economic or scientific logics. For this literature, technologies “always embody a compromise. [...] They are shaped by a range of heterogeneous factors [and] might have been otherwise.”²⁷ There is, in this sense, no single trajectory that determines the evolution of artifacts but a constellation of interests, moralities and visions of society that struggle to shape the course of technology. Yet technologies also shape social order and political dynamics. Technologies make possible “conditions for human relationships that have a distinctly political cast – for example, centralized or decentralized, egalitarian or

inegalitarian, repressive or liberating.”²⁸ Far from being neutral, technologies embed everyday politics. Studying debates and discussions around market technologies may thus articulate social studies of finance and the historical sociology of finance: if technologies are, indeed, a “mirror of our societies,”²⁹ as Bijker and Law suggest, histories of implementation—whether failed or successful—should provide a lens for appraising the politics of markets.

Morality, equality and the political philosophies of liberalism

What *explicit* politics are relevant to the study of financial markets? In this article, we focus on moral evaluations anchored on three varieties of liberal thought. In particular, we look at how economic actors used political philosophies and their correlated notions of justice, fairness and equality to frame market technologies. In doing so, we recognize liberal political conceptions as both macro-institutional theories of society and micro-social evaluations on the morality of social arrangements.

Our emphasis on liberal political conceptions is threefold. First, it follows from an important body of research in politics and philosophy that traces lineages between liberalism and notions of fairness, equality and justice. By understanding liberal political theories as frameworks through which actors evaluate their worlds, we seek to establish a connection with these literatures. Second, our choice derives from empirical observation: as will be clear below, the discourse of financial actors between 1960 and 2005 was rife with terms and discussions that resonate with at least three historical varieties of liberal

thought.³⁰ Third, given their historical preoccupation with conceptions of equality, an analysis of how liberal discourses were deployed in relation to market technologies allows connecting discussions on the infrastructures of finance with broader debates on justice and social order.

We should observe that the political philosophies explored here differ from the type of macro-structures that, as mentioned above, characterize much of the work in the historical sociology of finance and formal political institutions. Although this is partly a study in varieties of liberalism, we do not see individual instances as expressions of ‘large’ ideological structures constituted in a distinctly political domain and replicated strategically by market agents. Political philosophies are not boundary conditions; thus, this is not a story of moral claims and liberal ideals as instrumental resources used by actors in achieving their organizational ends. Rather, we understand the various liberal philosophies of market participants as part of every-day mechanisms of moral justification and sensemaking,³¹ entailing the legitimization of particular socio-technical orders. These liberal philosophies are not clearly bounded and neatly contained: the varieties of liberalism we refer to are convenient categories for organizing the discourses of market participants—in no way do we claim they are coherent, “autonomous and impersonal” structures that coordinate collective action.³²

In appraising the political philosophies deployed by market participants, we distinguish three archetypes. As noted above, these philosophical positions reflect conventional accounts of liberalism, which see liberal political thought developing historically from a

classical variety to more recent libertarian manifestations. Within this evolution, we are interested in studying the way each tradition conceptualized the nature and location of equality in the constitution of the market and the social world.

The first political philosophy, which political theorist John Tomasi identifies as classical liberalism, recalls the work of early scholars who, writing in the 18th and 19th centuries, were preoccupied with delineating the boundaries between individuals and collective institutions such as markets and the state. Classical liberalism is characterized by adhering to a formal conception of equality where the same rights are given to all as part of an original social contract: as Locke argued, people are “by Nature, all free, equal and independent, no one can be put out of this Estate, and subjected to the Political Power of another, without his own Consent.”³³ In devising a form of social organization that acknowledges such ‘state of nature,’ Locke claims that people establish a civil society and government upon which they deposit the legitimate exercise of political power. Submission to government is rewarded since this provides, as both Locke and Hume argue, a legitimate framework for preserving private property and maintaining the worthiness of contracts.

Classical liberalism is thus not a tender for minimal government but, rather, a thesis on its role in preserving the stability of economy and society.³⁴ As Tomasi writes, in this early liberal program, the “purpose of the state is to protect the freedom of citizens equally,” entailing a sovereign restrained “from impinging on the freedom of the citizens” in their *economic* activities.³⁵ To secure equality and freedom, however, classical liberals would

allow government to levy taxes on citizens' activity to provide basic infrastructures. Even for relatively 'modern' classical liberals, such as Hayek, there is no reason why "the state should not assist the individuals in providing for those common hazards of life against which, because of their uncertainty, few individuals can make adequate provision."³⁶

Whilst maintaining the primacy of private property and economic exchange as the basis of social organization, classical liberalism permits a fiscal system guaranteeing citizens equal enjoyment of constitutional protection and the ability to freely engage in the marketplace. For classical liberals, states exist to preserve markets.³⁷

Classical liberalism evokes what Ronald Dworkin called the conception of 'equality of welfare.' For Dworkin, equality of welfare "proposes [...] to make people equal in what is really and fundamentally important to them all."³⁸ From this perspective, justice and fairness are defined through the ability of the state to guarantee equal rights of access, independently of differentials in people's provenance or individual preferences. Classical conceptions of the marketplace as a public, freely accessible space are paradigmatic of such a moral framework: insofar as the state guarantees admission to the marketplace and protects its central institutions, it can be said to have fulfilled its moral obligation from a classical liberal perspective.

The above can be contrasted with a second conception that Tomasi identifies as 'high liberalism'. Key to high liberalist moral worldview is their call for a substantive distributive definition of justice.³⁹ High liberals argue that, like other contractualist social orderings,⁴⁰ equality of welfare is ultimately an arbitrary definition of what *ought* to be

fundamentally important. Since this does not take into account the multiple preferences of individual members of society, any distribution of rights and resources enforcing equality of welfare will, for a high-liberal, fail a critical test of fairness: envy between agents will invariably prevail. Evoking Rawlsian conceptions of justice as entangled to a deliberative original argument, Dworkin proposes a solution to the problem of fairness by arguing that “an equal division of resources presupposes an economic market of some form [which] as a device for setting prices for a vast variety of goods and services, must be at the center of an attractive theoretical development of equality of resources.”⁴¹ In support of this, Dworkin introduces the metaphor of an auction that, through a process of individualistic mutual adjustment, leads to an equilibrium state under which the envy test is met: for him, a just and fair distribution can only be obtained by allowing agents to barter and exchange until their preferences are collectively satisfied.⁴² In this conception, the role of the state is notably different from the restricted sovereign of classical liberalism: instead of defining the metrics of justice *ex ante*, high liberalists’ equality of resources entails a sovereign that provides an environment where agents are free to choose among a variety of options in order to reach a mutually defined *fair* outcome. Central to equality of resources is the efficacy of market signals coordinating valuation and exchange across society. As Tomasi observes, this liberal conception may well allow increasing the scope of state institutions in regulating business to guarantee that the price system remains a competitive, publicly visible signaling mechanism.⁴³

The third and final relevant political philosophy is libertarianism. Unlike classical liberalism’s conception of social order as based on a contractually-defined sovereign that

guarantees equal right to “life, liberty and property,” libertarians argue that maintenance of such right is the *a priori* condition for freedom and equality.⁴⁴ As Thomasi writes, while classical liberals imagine society as a cooperative enterprise, “libertarians are more likely to put rights center stage and defend whatever states of affairs emerge through the voluntary activities of right holders”.⁴⁵ This may well imply breaking apart from some conceptions of inalienable civil and political liberties: insofar as individuals have the right to self-govern, they may under their full knowledge engage in contracts that violate a broader social norm.⁴⁶

At the core of libertarian thought thus stands a “moral ideal of persons as self-owners.”⁴⁷ Such conception has two distinct consequences. First, it entails a minimal state whose sole responsibility is to enforce contracts and guarantee basic forms of physical security. The contractarian approach of classical liberalism is negated as a constraint on liberty. Second, libertarians place property at the center of liberty and freedom. They hence reject communal forms of ownership and advocate the importance of competition and privatization. Note, however, that libertarianism is not coextensive to neoliberalism: as Schumaker observes, although libertarians elevate economic rights above all other liberties, they pursue their goals through pluralist politics.⁴⁸

Classical liberalism, high liberalism and libertarianism entail different evaluations of what is just and equal. They are, in this sense, distinct philosophical and moral frameworks that place higher value on distinct forms of social organization: whereas classical liberals prize equal formal rights in accessing the market, high liberals value the

importance of a state that guarantees distributional fairness through an efficient price system, and libertarians advocate individual self-ownership and entrepreneurialism as the basis of fairness. What is positively moral and desirable in one framework may not be in the other: importantly, the ends and means of classical, high and libertarian liberals do not coincide.

Within the history of American financial markets, these three moral positions were represented by three distinct groups. On the one hand, the early advocates of electronic trading systems, including the proponents of the most radical design for a Consolidated Limit Order Book (the so-called hard-CLOB; see below), echoed the conceptions of classical liberals. A newer generation of technological entrepreneurs, however, imagined financial markets through libertarianism. And in the middle stood regulators that, like the Securities and Exchange Commission, conceptualized markets through a high liberal framework. Fragmentation originated not in the triumph of one conception over others but, rather, in the attempt to find common moral grounds within the market. As the SEC judiciously evaluated the different technological choices for American finance, it sought to create a system that appealed to all. And here, technology seemed an instrument for enabling a free, fair and just market—the vehicle for achieving a market utopia in finance. Technology, however, itself proved to be a source of tensions rather than solutions within the liberal architecture of finance: far from stabilizing relations and materializing equality, technological change shifted the architecture of markets in ways that eroded the SEC’s consensus. It is to this story of morality, utopia and failure that we turn to now.

American finance and the politics of access

Creating a national market

The history of the Consolidated Limit Order Book starts, like so many other histories in recent American finance, as a reaction to one of the prime institutions on Wall Street, the New York Stock Exchange.

The NYSE has been, ever since the early twentieth century, the backbone of American stock markets. As Europe lost its global position in the 1910s, New York rose as the undisputed capital of global corporate finance. And at the center of the system stood the New York Stock Exchange, an obligatory passage point for trading in the most active stocks of the burgeoning American economy.

The NYSE's centrality, however, made the organization a target of critique. Thus, in the early 1960s and owing perhaps to the expanded importance of capital markets and the lobbying of a growing industry of institutional investors, the NYSE attracted attention from Washington's policy circles.⁴⁹ Critics of the NYSE raised three points against the organization whose practices, they argued, resulted in an expensive, inefficient and opaque financial system. On the one hand, critics considered the historical control that the NYSE exerted over the trading of certain stocks unnecessarily restrictive. On the other hand, the organizational structure of the exchange—which gave only a small and select group of member brokers and market makers access to trading—was also judged an inefficient constraint. And third, some market participants considered the mechanism

of trading itself—which relied on granting a monopoly over trading on particular stocks to market makers known as specialists—as being immune to competitive price formation. For its critics, the NYSE was a cartel, and as such it required intervention. Responding to public calls for increased transparency, efficiency and competition, the United States Congress requested the SEC in 1961 to study the “adequacy [...] of the rules of national securities exchanges and national securities associations” in order to re-imagine financial markets for the future.⁵⁰

The outcome of this process was the multi-volume *Report of the Special Study of Securities Markets*, which became the first comprehensive reference on the structure and operation of what had hitherto been a fragmented and little understood market system. As Millo has rightly argued, written by ad hoc staff loosely associated to the Commission and presenting the most “up-to-date [analysis] of the sectors’ strengths and problematic areas,” the process of researching, drafting and submitting the report “reinforced the experts status that was granted to the SEC staff.”⁵¹ Indeed, the *Special Study* was catalytic: it budged the Commission away from its original focus on investor protection and financial disclosure as delineated by the Securities Exchange Act of 1934. The *Special Study* became a unique opportunity to redefine the SEC’s role in shaping the architecture of securities markets in substantive, proactive ways.

In its search for efficiency, the SEC soon noted that markets could be transformed through technology. In contrast with previous studies, the *Special Study* contained ambitious discussions on the horizons of automation, particularly with respect to the

expanding (and relatively opaque) over-the-counter markets in NYSE-listed stocks. For these, the *Study* noted the possibility of developing a “centrally located computer” that would

select the best bids and offers, execute orders, and clear transactions. Transmitting and receiving units would be installed in the offices of all subscribing broker-dealers. Wholesale dealers and other broker-dealer subscribers could enter quotations (and size of market) into a central computer for indexing under the appropriate security and could interrogate the computer to determine the highest bid and lowest offer, selected by the computer, together with the number of shares bid and offered at such prices. [...] This would enable a broker-dealer to execute at the best prevailing price or, if he chose, to enter his own limit order in the hope of bettering that price. Thus, [in the view of the engineers] the principal barrier to the crossing of public orders—namely, lack of a central location—could be overcome by the use of a single, central computer.⁵²

Automation, argued the SEC, was of “great importance to the industry itself, because of the potential for improved efficiency and economy.”⁵³

To the writers of the report, automation was revolutionary. Indeed, for the *Special Study*, existing automation projects were incipient (it noted, for instance, that “despite the NYSE’s interest in automation, [...] progress with respect to exchanges’ trading mechanisms has not been impressive”). Automation, in particular, would solve the “basic problems that have historically characterized both the operation and regulation” of markets by creating a single central marketplace under the SEC’s purview.

While the *Special Study* of 1963 heralded the SEC's ambition to create a central market, it was only in the early 1970s that the concept clearly entered the Commission's mandate. And at the core of this change stood was one the most critical technological failures in the history of Wall Street, a period between 1968 and 1969 during which the matching and clearing of the growing volumes of trades became physically unmanageable. Unable to clear the transactions of 'normal' trading days, the NYSE limited trading hours and closed on Wednesdays to guarantee the operation of the floor.⁵⁴ The visibility of this back-office crisis led to immediate intervention: searching for an offender, Congress requested the SEC to investigate the state of market activity and, in particular, to determine the role played by institutional investors in the event.

The ensuing 1971 *Institutional Investor Study* built upon previous discussions on automation and reinforced regulatory solutions based on centralization through technology. In particular, the report observed the need to 'dematerialize' paper-based certificates, the management of which had been associated to Wall Street's paper jam. By transforming certificates of ownership into electronic files on a central computer, the operational problems of clearing and settling transactions in stocks could be resolved.

But if technology made possible the centralization of settlement, it enabled too the centralization of trading. Technology could connect the multiple trading sites in America to form the central market system "competitively based, with minimum restrictions on trade" that, since the early 1960s, was core to the SEC's objectives.⁵⁵ This central market

would consist of a “system of communications by which the various elements of the marketplace, be they exchanges or over-the-counter markets, are tied together. It also includes a set of rules governing the relationships which will prevail among market participants.” And by including exchanges, specialists and over-the-counter market makers, the central market system would

reduce the element of monopoly power which has accompanied past efforts to establish a central market and will make it possible for potential abuses of such monopoly power to be controlled not only by regulation but to an increasing degree by competition. [Our] objective is to see a strong central market system created to which all investors have access [and] which is controlled not only by appropriate regulation but also by the forces of competition.⁵⁶

The *Institutional Investor Study*, however, did not specify implementation. What should a ‘strong central market system’ to which ‘all investors gave access’ to look like? Should it use, for instance, the NYSE’s trading floor as the basis for a national central exchange?⁵⁷ Or should it challenge incumbents and foster new organizational forms? The choices were multiple, contested and, in all instances, politically costly.

Despite ambiguities about the central market, the *Institutional Investor Study* revealed the SEC’s moral ‘matters of concern.’⁵⁸ Compared to the New Deal institution of the 1940s and 1950s, the SEC of the 1970s professed a different market imperative: articulating competition to create price efficiency as a common good. Indeed, the transition from investor protection and enforcement to actively shaping markets reflected a shift across political philosophies. Whereas the SEC’s initial focus spoke to the importance of

property rights and confidence in individual marketplaces, its subsequent concern with integration spoke to the import of competition and the price system. Arguably, the Commission's earlier philosophy matched classical liberalism, seeing itself as an extension of a sovereign "protect[ing] the freedom of citizens equally." But as it adopted new expertise, it shifted towards high-liberalism: beyond surveillance and enforcement, the SEC's role was to establish an efficient, public and competitive price mechanism.⁵⁹

This shift may well explain why, in addition to the central market, the SEC pursued other projects. Indeed, discussions on the central market system themselves generated alternatives that resonated with the SEC's goals. The SEC's Advisory Committee on a Central Market System noted in 1973, for example, that rather than seeking to define an entirely novel, all-encompassing central trading system, exchanges and stakeholders would prefer a 'consolidated tape' for reporting real-time quotes and trades from public US stock markets. As Paul Kolton, President of the American Stock Exchange, argued at the time, such price aggregator would fulfill the SEC's mandate by guaranteeing that "the public order that enters the system—that is, captured electronically—[...] is switched to the best market, [...] is assured of the best execution, [and is] executed within the framework of an auction market system [i.e. a stock exchange]."⁶⁰

These technical and ideational transformations echo the type of ideological shifts described in Polanyi's classical account of capitalist market economies.⁶¹ Prior to the debates of the early 1960s, the institutions that comprised American stock markets were closer to local markets that, functioning "without an economy," were partially

disconnected and subjected to “rituals and ceremonies which restrict [their] scope while assuring [their] ability to function [within] given narrow limits.” The parallels are particularly visible in closed organizations such as the NYSE: at least one of the rules of the Exchange, NYSE’s Rule 493, prohibited members of the organization from trading through over-the-counter dealers, creating a monopoly in the trading of exchange-listed stocks. While eliminating individual institutions such as Rule 493 proved difficult, the SEC’s reinvention in the early 1970s was a moment for constructing an internal, national stock market. Discussions of the central market system were first steps. And so was the creation of a consolidated tape that eroded boundaries between previously local trading sites. But a full Polanyian transformation required designing and enshrining in law an integrated national market that would serve the collective interest of American investors, providing a cheap, efficient and competitive pricing mechanism for corporate stocks. The critical juncture⁶² occurred in 1975 when US Congress amended the Securities Exchange Act 1934: from then onwards, it became the SEC’s statutory obligation to “remove impediments to and perfect the mechanisms of a national market system for securities and a national system for the clearance and settlement of securities transactions and the safeguarding of securities and funds related thereto.”⁶³

CLOBs, equality and efficiency

As a critical juncture, the 1975 Amendments to the Securities Exchange Act provided a framework for two key transformations within the SEC. The first concerned the Commission’s conception of markets. Following from earlier debates, the SEC interpreted its mandate to establish the national market system (NMS) as fostering inter-

market competition. The experiment of the consolidated tape partly demonstrated that an efficient national price system could be built in principle by connecting marketplaces to increase transparency and enforce competition. The second change involved the strengthening of the SEC's regulatory scope. Framed in relatively ambiguous terms, the 1975 Amendments gave the SEC "tremendous leeway in implementing" NMS,⁶⁴ which made possible for the Commission to explore a number of novel organizational projects.⁶⁵ Perhaps one of the most interesting—if eventually failed—was the proposal to build a national Consolidated Limit Order Book which, continuing the logic of the central market system, would have brought together stock trading under a single electronic system.

CLOB was proposed with great support across regulatory and market sectors. In 1975, for instance, the Advisory Committee on Implementation of a Central Market System noted that CLOB was an "essential element" of NMS, based on principles of "time, price, and public order priority"; and in 1976, the National Market Advisory Board strongly advocated a CLOB "linking the individual [trading] books of specialists."⁶⁶ Similarly, as Donald Weeden recalled, even the Securities Industry Association's National Market System Committee, which had a strong participation of New York and American stock exchanges members, recommended CLOB as the "fairest trading mechanism which maximizes the opportunity of orders to meet without intervention of a dealer."⁶⁷

Disagreement existed, however, around how best to implement a CLOB. In particular, there were two options. The first largely mimicked the consolidated tape: rather than

merging trading centers, NMS could rely on a 'soft' CLOB that would offer "a composite quotation system and intermarket linkage [allowing for the] execution of orders left in the system only by specialists and qualified market makers."⁶⁸ A soft CLOB would maintain "the strengths of present markets" but would overcome the problem of a physically fragmented price mechanism through technology, generating a virtual aggregate of the quotes and trades of different regulated trading venues. For the SEC, soft CLOB was particularly attractive; maintaining the "strengths of present markets" was, indeed, synonym to political pragmatics: the Commission could create an efficient, "fair and honest"⁶⁹ national price system without challenging powerful incumbents or straying too far from the existing securities markets legislation.

A second option entailed physical centralization in a computer file that would receive and execute all orders in the market under strict price-time priority. This 'hard CLOB', argued proponents, had the crucial advantage that "orders in the book would always have priority at a price over any other orders in the system at that price." As noted by the National Market Advisory Board, by guaranteeing a national standard of order routing and execution, hard CLOB would "contribute the most to reestablishing the confidence of individual investors," constituting the "fairest and most efficient" implementation of NMS.⁷⁰

As distinct 'market devices', the soft and hard CLOBs entailed different 'sortings' of markets and society, patently dissimilar 'matters of concern.'⁷¹ Soft and hard CLOBs

were different *political* projects: while both entailed some degree of centralization, they envisioned very different types of fairness, equality and politics in markets.

Enter, thus, Junius Peake, an economist, technologist and entrepreneur who was central to the formulation of NMS—and who was perhaps the staunchest proponent of hard CLOB. Born in 1932, Peake started his Wall Street career in 1950 when he joined the brokerage firm Garvin, Bantel & Co. There, and due to his notorious interest in market technologies, he was put in charge of “changing the ink on the TransLux ticker machine.” Having moved onto managing settlement and clearing operations in the 1960s, Peake had a privileged “front row view” of the back-office crisis. At the time, Peake had been made partner of Shields & Co., a brokerage firm where he oversaw the computerization of settlement with great success: whilst other firms faced strains as volumes mounted during the crisis, Shields & Co. suffered only minimal overtime, as he noted then in the *New York Times*.⁷²

Peake’s experience with computers made him an obvious and vocal proponent of the automation of both trade and settlement through the ‘dematerialization’ of stock certificates. Indeed, Peake’s advocacy found a niche at NASD, the over-the-counter electronic marketplace where he served as a member of the board of governors and through which he became a frequent contributor to congressional hearings on finance. And in his the congressional testimonies, Peake outlined his techno-political philosophy. For instance, as he noted in 1973,

[the] clerical problems [of Wall Street] would be solved by eliminating use of the physical certificate [through the development of a central electronic depository that would perform] the function of the certificate by electronic means. The record of ownership and interest would be recorded, maintained, and transferred; and the recording entity would be able to account for it, at all times. A truly comprehensive, national securities depository, performing the functions presently done by the many unrelated transfer organizations would reduce the flow of paper to a minimum and would satisfy the public's felt need for the comfort of tangible property by permitting the delivery of certificates outside the system.

Note in the above the classical liberal philosophy of Peake's vision. Whilst a modernizer, Peake thought of automation as a means for increasing the efficacy of the institution of 'tangible property.' He did not oppose government intervention. Rather, bolstering property rights could only occur through Congress, who could "make the final determination as to the interests of the national economy and the investors."⁷³ Like the boundaries of private property, the regulatory architecture of markets was a prerogative and responsibility of a sovereign state that brought order and peace to exchange.

While Peake's classical liberalism influenced his views on settlement, it was starker in his contributions on trading to the National Market Advisory Board. Among these, one is particularly salient: his 1976 co-authored proposal to develop a National Book System that sought to fully implement the NMS.⁷⁴ The system proposed by Peake and his colleagues Morris Mendelson and R.T. Williams amounted to a hard CLOB. Instead of linking marketplaces through such systems as the consolidated tape, Peake's system

collected the bids and offers of both professional market makers and individual investors for each security and matched them accordingly in a central electronic file. Within this model, orders were anonymous, and importantly, price-time priority on the execution of bids and offers was guaranteed.

Peake's proposal differed from the SEC's soft CLOB in its conception of an ideal market. For the SEC, fair markets were those that guaranteed price efficiency, requiring competition *between* trading venues within NMS (reflecting, perhaps, the Commission's involvement with anti-trust legislation in capital markets). As a former staff member involved in the 1975 Amendments recalls, the SEC "clearly felt that the industry should be encouraged, nudged, and prodded to [implement intermarket competition] themselves."⁷⁵ Thus, and consistent with a high-liberal political philosophy, the SEC's role was to safeguard efficient prices and fair markets by implementing "rule making when necessary." For Peake, however, ideal markets required *competition in prices within* a single setting. As Peake tellingly noted in 2003, the question of what is a market had, for him, a clear answer: "Is a market a price or a place? I say it is a price."⁷⁶ In effect, for Peake, efficiency's moral imperative simply could not result from competition between trading venues:

An economist would require for a perfect national market system that *all* participants [...] have an equal opportunity to vie for profit on a fair field of competition, with equally available trading information and with equal access to the trading arena. The present market system is not perfect: Trading information is available to certain competitors instantly, and not available to others at all; the

field is composed of membership organizations that restrict access to the game to members.⁷⁷

Rather than constructing in interconnected system, wrote Peake, NMS “should be directed towards achieving the economist’s dream:” a single, non-fragmented market.

Indeed, fragmentation, noted Peake,

can be eliminated by a unitary system. While a single stock exchange would be a unitary system, it would also have a single market maker—and Congress wants fully competitive market makers. Fortunately, the technology now exists to construct a market mechanism in which *all* orders can interact and which preserves fully competitive market making. Computers have the speed and power to queue, display and match like-priced orders of investors, large and small, from all over the nation, and throughout the world.⁷⁸

Peake was not alone in advocating a centralized computer as a solution to questions of justice confronting American stock markets.⁷⁹ His advocacy was distinctive, however, for it placed center stage the politics that, for him and other market users, ought to have been key to the reorganization of finance. For Peake and colleagues, the problem was access and equality.⁸⁰ Efficiency was only valuable resultant from fair market organization. And as he argued, “if one class of group has access to necessary market facilities on more favourable terms than others, competition is not ‘fair’. There is no justification, given today’s level of technology, for limiting access to a favoured few.”⁸¹ Equality hence necessitated a form of centralization unattainable with a soft CLOB: “while centralizing information flows or arbitraging between markets may equalize prices of a given security

if the flow of information is maximized,” wrote Mendelson in 1971, “equity will not be produced. Without an execution focal point, there is no way for the first come to be the first served.”⁸²

If a little broker-dealer in Tacoma, Wash., wanted to interject a superior bid or offer into the system, that little broker-dealer in Tacoma, Wash., would know that it would be first in line when the stock moved to that bid or offer. Merrill Lynch with all its size and all of its clout and all of its resources could never get ahead of them. The importance of price and time priority is that it places the little fellow in Tacoma, Wash. on the same footing as Merrill Lynch. (Peake 2000)⁸³

Only through a hard CLOB could ‘truly’ equitable markets exist.

Seeking consensus with incumbent market participants such as the New York and regional stock exchanges, the SEC’s pragmatist attachment to the soft CLOB was thus in stark contrast to Peake, Mendelson and William’s dream of a centralized execution facility. The divergence was both technical and ideological, recalling the difference that Dworkin draws between welfare and resource equality in classical and high liberal thought: While a hard CLOB entailed “treating people as equals,” the SEC’s soft CLOB implied “treating people equally”⁸⁴ with respect to a resource—a transparent and efficient price system that resulted from NMS. For the SEC, the ends of CLOB were efficiency; for Peake, they were first and foremost instituting equality through technology.

Fragmentation as opportunity: technology and the death of CLOB

Just as hard CLOB emerged as from the affordances and possibilities of technologies, its ultimate demise was similarly tied to technical and organizational changes in American finance.

By 1979, the SEC had established two key elements of a national market system. The first of these—the consolidated tape—derived from an early compromise to increase price and trade transparency. This was not a trading mechanism, though: the tape merely gave investors integrated data on stock prices and reported transactions. Trading integration required a second mechanism, the inter-market trading system, ITS, introduced by the NYSE, AMEX and regional exchanges in 1978. Unlike the consolidated tape, ITS transmitted orders between marketplaces, operating as a partial channel for competition between exchanges. ITS was, furthermore, a triumph of compromise: sponsored by the NYSE in reaction to the SEC’s pressure, ITS reinforced the Exchange’s centrality and made unnecessary developing the remaining element of the NMS, a hard CLOB.⁸⁵

The SEC’s distancing from hard CLOB as a cornerstone of the NMS was only clear in 1994, though, when Congressional interest in providing “guidance for the development of a National Market System” produced the *Market 2000* report. Written in response to “concerns about possible market fragmentation, inadequate disclosure of market information, and uneven regulation among competitors,”⁸⁶ *Market 2000* publicly rejected

the SEC's longstanding concern with centralization to emphasize instead the virtues of competition and interconnection. As the report argued, views on a hard CLOB were divided between the New York Stock Exchange and advocates of NMS. For the former, CLOB would "expose market makers to greater risk" without gaining further liquidity; for the latter, CLOB "would allow for improved price discovery and best execution for customer order[s]." Analyzing the political and technical strengths of ITS, the SEC sided with the Exchanges. Although ITS "is not, and was not intended to be, a complete intermarket linkage," concluded the SEC, "it is not necessary at this time to expand [the system] into a CLOB or to require automated executions of commitments."⁸⁷ Rather, by "enhancing ITS to improve its efficiency and reliability," a system similar to a soft CLOB could be created by "a web of portal executions coming together that allow functionally the transparency of a central limit order book."⁸⁸ Indeed, a national market could be built "without dictating a particular structure," wrote the Commission. "[T]rading venues a thousand miles apart but linked electronically are as much a single market today as were broker-dealers across the room from each other yesterday. The market they comprise cannot be described as fragmented."⁸⁹

The shift away from centralization was coupled, indeed, to unique techno-organizational innovations: so-called electronic communication networks and alternative trading systems that created private solutions to the problems of off-exchange trading. Despite the SEC's attempts to enact transparency, by the time *Market 2000* was published, a growing number of market participants openly questioned the legitimacy of the NYSE and NASDAQ as 'closed' organizations that made markets arbitrarily expensive.⁹⁰ Much

like the early critiques of Peake and other first-generation automators, sophisticated activists in the 1990s advocated ‘fairer’ venues for exchange. The result was a flurry of firms that, harnessing information technologies and novel incentive structures, opened new trading spaces in the United States. New electronic marketplaces, however, changed market structures. Would these new venues “competing for order flow [...] fragment the market?”

For the SEC, the risk of fragmentation required intervention: thus, in February 2000, the Commission requested market participants to comment on “whether fragmentation is now, or may become in the future, a problem that significantly detracts from the fairness and efficiency of the U.S. markets.”⁹¹ A deluge of comment letters followed, and as the discussion gained prominence, Congress held hearings to discuss the effects of technological change in American finance.

The congressional hearings on *Competition in the New Electronic Market* laid much of the regulatory groundwork upon which algorithmic trading flourished in subsequent years. And politically, the hearings were a critical juncture, defined by the presence of a novel libertarian philosophy that contrasted with previous conceptions of market equality. Such philosophy was particularly clear amongst the founders of the new electronic marketplaces, who put private rights center stage and defended market competition as uniquely virtuous. Unlike earlier generations of market innovators who considered CLOB a solution to fundamental problems of equality, the later generation of market technologists opposed centralization owing to its anticompetitive nature. As Kevin Foley,

Chief Executive of Bloomberg Tradebook argued, creating a CLOB to deal with fragmentation was erred. A central black box

runs contrary to the operation of state-of-the-art modern telecommunications, the Internet being the best model. The innovations that ECNs have brought to the market [...] could not occur under an industry sponsored CLOB, an industry-sponsored black box [...] It creates a centralized single point of failure, and it creates a single decision making apparatus that is resistant to change.⁹²

For Foley, furthermore, discussions of fragmentation only reinforced the anticompetitive practices of established trading venues. As he told Congress, “[w]hen the status quo laments the impact of ‘harmful fragmentation’ be careful—often it is really bemoaning beneficial competition.” The moral imperative of competition was present across the new generation of market technologists: as Cameron Smith, General Counsel of Island ECN mentioned several years later, for instance, the “fundamental issue” confronting markets was not competition between orders within a single CLOB. Rather, “We believe that there should also be competition between markets.”⁹³

Others, such as Matt Andresen of Island ECN, highlighted financial innovation’s democratic dimension. Whilst in 1980 only one in ten Americans invested in the stock market, observed Andresen,

Today that number is over 52 percent. While these investors have new-found access to market research and market data, some proposed taking a giant step backwards from these innovations by calling for a central limit order book or so-called CLOB. Its advocates claim that the CLOB would cure the fragmentation

allegedly attributable to [ECNs]. I argue that ECNs have, in fact, consolidated the markets. [...] What would the effect be of a government-installed CLOB? One of the most immediate effects would be to eliminate a market participant's ability to compete on the basis of speed, reliability and cost, in essence, dumbing down the innovative technology, which has so benefited investors.⁹⁴

The ECNs' libertarian philosophy thus stressed private spaces of innovation and entrepreneurialism. This was perhaps most notable in John Schaible's testimony. As Schaible, President of NexTrade, argued,

[the] competitive for-profit model exemplified by ECNs has had a proven, beneficial impact on our markets. In 1998 alone, the cost of a trade on NASDAQ fell 23 percent and spreads fell 41 percent. While ECNs have helped investors, this progress is minimal in comparison to the benefits that will be derived from the privatization of stock exchanges. Privatization will result in exchanges that are more competitive and will respond better to the needs of the investors. New for-profit exchanges will enable the United States to maintain its position as the preeminent global market.

Indeed, for these actors, fragmentation neither resulted from inequality nor generated inefficiency. On the contrary, it was the *raison d'être* of the new electronic marketplace: talking to the *LA Times*, broker Charles Schwab noted, "What some call fragmentation [...] we call competition." As competitive electronic markets matured, hard CLOB faded into obscurity.

Conclusions: the many neo-liberalisms of fragmented markets

Why did hard CLOB fail despite initial copious support? Until about 2005, the answer seemed clear: technological innovation made it disproportionate to the SEC's aims.

Through a series of order handling rules,⁹⁵ the Commission could foster a version of the NMS by creating what economist Craig Pirrong calls a Simulacrum Limit Order Book—SLOB, a virtual, multi-exchange system that shared many of the characteristics of CLOB without centralized order execution. NMS is, perchance, “in the eye of the beholder,” as the founder of the electronic Arizona Stock Exchange, Steven Wunsch, argued in 2003. “The SEC uses it that way. So does every rent-seeking participant in the marketplace.”⁹⁶

Although fragmented by construction, SLOB seemed a palatable agreement between the SEC's soft CLOB and the private markets of ECNs. As a loose system of interconnected trading venues, SLOB crosscut the interests of the SEC and broad market constituencies, offering stock market integration, price efficiency, and intermarket competition on the one hand, and the recombinant effects of democratization, entrepreneurialism and privatization on the other. Here lies one of the contributions of studying technologies within the historical sociology of finance: technologies embody compromise. Market technologies resulted neither from innocuous economic forces nor from the hierarchical imposition of singular ideologies. Rather, they reflected translations, negotiations and alignments across political domains. Indeed, SLOB happened largely because it coalesced the liberal politics of the SEC and ECNs. Rather than being an arbitrary dictate by the sovereign, SLOB gave users choice. As Wunsch stressed, whilst the centralized price time priority of hard CLOB “eliminates the ability of individual markets to

distinguish themselves by providing a particular *kind* of time and price priority, or a certain type of order-handling treatment that may be required to attract [specific types of investors],” the system of “multiple types of markets [let] the public choose.”⁹⁷

By late 2005, however, the compromise no longer held valid. Whereas it previously seemed that “maybe we don’t need to think about place anymore,”⁹⁸ innovation made space and fragmentation once again relevant. The growth of electronic trading venues, coupled to regulations integrating financial markets, created incentives for algorithmic trading strategies that arbitrage information and the speed of trade execution. For these, distance to the computer servers of trading venues is integral to trading: the closer they are, the sooner they receive market data. In the markets of algorithmic trading, equality of access was no longer technologically guaranteed.

The history of CLOB thus suggests market fragmentation as the consequence of a two-phased ideational transition. During the first phase, the SEC’s project of market centralization found an ally in a first generation of automators who advocated technological solutions to problems of equality in American finance. Two concepts emerged from this convergence: NMS on the one hand, and the consolidated limit order book on the other. In particular, whereas CLOB spoke to structural issues of market access, NMS catered to the SEC’s interest in nation-wide competition. This phase thereby entailed a compromise between classical and high liberal philosophies, between equality of welfare in the form of CLOB, and equality of resources through NMS. Although different conceptions of markets and society, these two philosophies were articulated by a

shared emphasis on price competition, be it within CLOB or NMS. Debates around markets moved, however, to a second phase that featured a quite different compromise. Rather than emphasizing competition in prices, in this later phase the SEC embraced inter-market competition as paradigmatic of ideal markets. With this, the Commission re-imagined a national market system *without* centralization. This shift resonated with a second generation of market technologists who, in their libertarian philosophy, highlighted the democratizing benefit of innovation and voiced concerns of government intervention. A new informal alliance was formed that tolerated fragmentation as part of the competitive space.

[Insert table 1 here]

What motivated the transition? We posit three broad factors. The first was technological. As noted above, innovations in the late 1990s and early 2000s allowed the SEC to create a national market system that provided both equality of access and freedom of choice by introducing new regulations within the existing legislative framework. This made hard CLOB unnecessary and increased the payoff of bearing new market participants, even if these led to market fragmentation.

The second factor was political strategy. The SEC's shift from the centralized market system in the 1960s to the loosely interconnected national network of 2005 was partly political pragmatism: strong centralization required challenging incumbent stock exchanges and passing a suite of (potentially unpopular) legislative reforms. Rather than

embarking on a debilitating, confrontational process of reform, the Commission worked within the flexible mandate of the 1975 Amendments, emphasizing the consolidated tape, ITS and regulatory rule-making as mechanisms for fostering competition. This shifted the weight between existing options: soft CLOB became more practicable, hard CLOB less so. The transition between the two phases therefore reveals some of the paths of least political resistance that were available to the Commission between c. 1970 and 2005.

The third ostensive factor was regulatory ambiguity. Reflecting, perhaps, legislative activity within the ‘weak’ American state,⁹⁹ the 1975 Amendments to the Securities Exchange Act made NMS part of the SEC’s mandate but failed to specify its terms of implementation (as noted above).¹⁰⁰ (The SEC was also limited by design. As Burk notes, the high turnover of SEC commissioners resulted in a “history of transient policy commitments rather than consistent implementation”¹⁰¹). Hence, definitional discussions of the NMS—such as those within the National Market Advisory Board—became sites of inter-jurisdictional struggles: there were potentially as many NMS models as interests groups in and around the market. These were justified, furthermore, within a broader political culture that, as Dobbin notes, assumes an inextricable link between justice and efficiency: market proposals overtly specified conceptions of justice—from the classical ideals of Peake and hard CLOB, to the libertarian projects of the ECNs—and held on to known (liberal) tropes and repertoires of fairness and equality.¹⁰²

For the historical sociology of finance, studying the trajectories of market fragmentation therefore contributes to understanding the location of neoliberalism in modern, capitalist

societies. If anything, within this account, neoliberalism is prominent because of its absence. For instance, while fragmentation was ostensibly associated to a process of privatization through which, echoing Mudge, once ‘sacralized’ status-groups were challenged by ‘profane’ entrepreneurial organizations,¹⁰³ financial markets were always and remain eminently private spaces. Furthermore, a coherent ‘repertoire of policies’ characterized by ‘central tenets’¹⁰⁴ is empirically unclear: if anything, decisions on market structure were forged at the intersection of numerous and contrasting political philosophies. Similarly, debates about financial technologies rarely assumed the “market as the source and arbiter of human freedoms.”¹⁰⁵ On the contrary, at stake in the discussion of market structures were different ideals of liberal organization.¹⁰⁶ Indeed, the fragmented landscape of contemporary American finance resulted from interactions across a series of path-dependent processes that, whilst related, were contingent and structurally decoupled: as a historical object, market fragmentation was, like the flash crash, an unintended consequence of the fragmented political philosophies of US stock markets. Within the space of algorithmic trading, the political contours of neoliberalism are thus best understood as emergent phenomena: through the philosophical struggles to shape the architecture of NMS, stock markets came to contain not one but multiple forms of liberal politics that, in questioning, revising and adapting to change, created the conditions for fragmented, automated forms of finance.

<i>Political philosophy</i>	Classical Liberalism	High-Liberalism	Libertarianism
<i>Period</i>	1960-1990	1960-2005	1990-2005
<i>Relevant actors</i>	First generation stock market automators (e.g. Junius Peake)	Securities and Exchange Commission	Electronic Communication Networks (e.g. Island)
<i>Views of incumbents</i>	Stock exchanges as cartels	Stock exchanges as anti-competitive	Stock exchanges as inefficient
<i>Conception of Justice</i>	Justice as equal access to the marketplace	Justice as national price efficiency	Justice as freedom of choice
<i>Moral imperative</i>	Access	Competition	Innovation
<i>Technological projects</i>	National Market System, Hard CLOB	National Market System, Soft CLOB, Consolidated Tape and Inter-Market Trading System	Privatization / Free competition
Points of convergence	Market integration, price competition		
		National price improvement, inter-market competition	

Table 1. Political philosophies and technological projects in American finance, c. 1960-2005.

¹ Tom Lauricella and Peter McKay, “Dow takes a harrowing 1,010.14 point trip,” *Wall Street Journal*, 7 May 2010.

² Tom Braithwaite, “Watchdogs under pressure on market swings,” *Financial Times*, 8 May 2010.

³ US Securities and Exchange Commission, *Findings Regarding the Market Events of 6 May 2010* (Washington, D.C.).

⁴ A caveat: a flash crash also occurred in 1962, before computers arrived on American trading floors.

⁵ Matthew Zook, “The virtual economy,” in *The Wiley-Blackwell Companion to Economic Geography*, ed. Trevor J. Barnes, Jamie Peck, Eric Sheppard. (Oxford: Blackwell Publishing, 2012), 298.

⁶ Ben Little, “Class and generation under neoliberalism,” in *After Neoliberalism? The Kilburn Manifesto*, ed. Stuart Hall, Doreen Massey, Michael Rustin. (London: Lawrence & Wishart, 2013).

⁷ Elvin Wyly, “The city of cognitive–cultural capitalism,” *CITY*, 17, no. 3 (2013), 387 – 394; see also Philip Mirowski, *Never Let a Serious Crisis Go to Waste: How Neoliberalism Survived the Financial Meltdown* (London: Verso, 2013), and Paul Crosthwaite, ‘The Accident of Finance,’ in *Virilio Now: Current Perspectives*, ed. by John Armitage (Cambridge: Polity, 2011), pp. 177-99.

⁸ Michael A Peters, “The crisis of finance capitalism and the exhaustion of neoliberalism,” *Truthout*, accessed 1 October 2013, <http://www.truthout.org/opinion/item/17536-the-crisis-of-finance-capitalism-and-the-exhaustion-of-neoliberalism>

⁹ Merton Miller, “Financial Innovation - the Last 20 Years and the Next,” *Journal of Financial and Quantitative Analysis*, 21, no. 4 (1986), 459-471; Merton Miller, “Financial Innovation, Depository-Institution Deregulation, and the Demand for Money,” *Journal of Macroeconomics*, 8, no. 3 (1986), 279-296; Frank Allen, F., & Gale, D. “Optimal Security Design,” *The Review of Financial Studies*, 1, no. 3 (1988), 229-263.

¹⁰ Data taken from Fidessa’s Fragulator, accessed 5 September 2013, <http://fragmentation.fidessa.com/fragulator/>

¹¹ Sal Arnuk and Joseph Saluzzi, *Latency Arbitrage: The Real Power Behind Predatory High Frequency Trading*, Themis Trading LLC White Paper (4 December 2009), accessed 10 October 2013, http://www.themistrading.com/article_files/0000/0519/THEMIS_TRADING_White_Paper_-_Latency_Arbitrage_-_December_4__2009.pdf

¹² Michéle Lamont, “Toward a comparative sociology of valuation,” *Annual Review of Sociology* vol. 38 (2012): 201-221.

¹³ Bruce Carruthers, “Historical Sociology of Modern Finance” in Karin Knorr Cetina and Alex Preda, *The Oxford Handbook of the Sociology of Finance* (Oxford: Oxford University Press, 2012): 491-509.

¹⁴ Carruthers, “Historical Sociology of Modern Finance,” 491.

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- ¹⁵ For instance, Neil Fligstein. *The Architecture of Markets: an Economic Sociology of Twenty-First-Century Capitalist Societies* (Princeton, Princeton University Press). On fiscal and financial policies, consider Monica Prasad, *The Land of Too Much: American Abundance and the Paradox of Poverty* (Cambridge, MA: Harvard University Press, 2012), 249-258; Greta Krippner, *Capitalizing on Crisis: the Political Origins of the Rise of Finance* (Cambridge: Harvard University Press, 2011). For other works intersecting politics, economy and finance, see Dirk Zorn, "Here a Chief, There a Chief: the Rise of the CFO in the American Firm," *American Sociological Review*, vol. 69, no. 3 (2004): 345-364; Mark S. Mizruchi, Linda Brewster Stearns, and Christopher Marquis, "The Conditional Nature of Embeddedness: A Study of Borrowing by Large U.S. Firms, 1973-1994," *American Sociological Review* vol. 71, no. 2 (2006): 310-333. John Bellamy Foster, "The Financialization of Capitalism," *Monthly Review* 58, no. 11 (April 2007): 1-12; Herman Schwartz, "Housing, the Welfare State, and the Global Financial Crisis: What is the Connection?," *Politics & Society*, vol. 40, no. 1 (2012): 35-58; Gunnar Trumbull, "Credit Access and Social Welfare: the Rise of Consumer Lending in the United States and France," *Politics & Society* vol. 40, no. 1 (2012): 9-34.
- ¹⁶ Nicos Mouzelis, "In Defense of 'Grand' Historical Sociology," *British Journal of Sociology* vol. 45, no. 1 (1994): 31-36.
- ¹⁷ Max Weber, "Politics as a Vocation," in H. H. Gerth and C. Wright Mills (eds.), *From Max Weber: Essays in Sociology* (Abingdon: Routledge, 1991), 78.
- ¹⁸ Marion Fourcade and Kieran Healey, "Moral Views of Market Society," *Annual Review of Sociology* vol. 33 (2007): 285-311.
- ¹⁹ Mark Granovetter, "Economic Action and Social Structure: the Problem of Embeddedness," *American Journal of Sociology* vol. 91, no. 3 (1985): 481-510; see also Neil Smelser and Richard Swedberg, *The Handbook of Economic Sociology* (Princeton: Russell Sage Foundation, 2005).
- ²⁰ See, in particular, Wiebe Bijker and John Law (eds.), *Shaping Technology/Building Society* (Cambridge: MIT Press, 1994); Wiebe Bijker, Thomas Hughes and Trevor Pinch, *The Social Construction of Technological Systems* (Cambridge: MIT Press, 2012); Donald MacKenzie and Judy Wajcman, *The Social Shaping of Technology* (Buckingham: Open University Press, 1999).
- ²¹ Donald MacKenzie, *Material Markets: How Economic Agents are Constructed* (Oxford: Oxford University Press, 2008), 2.
- ²² Philip Mirowski and Edward Nik-Khah, "Markets Made Flesh: Performativity, and a Problem in Science Studies, Augmented with Consideration of the FCC Auctions," in Donald MacKenzie, Fabian Munieasa and Lucia Siu (eds.), *Do Economists Make Markets? On the Performativity of Economics* (Princeton: Princeton University Press, 2007), 215.
- ²³ Michel Callon, "Performativity, Misfires and Politics," *Journal of Cultural Economy* vol. 3, no. 2 (2010), 163.
- ²⁴ Annelise Riles, "Collateral Expertise: Legal Knowledge in the Global Financial Markets," *Current Anthropology* vol. 51, no. 6 (2010), 806.
- ²⁵ Riles, "Collateral Expertise."
- ²⁶ See note 20 above.
- ²⁷ Bijker and Law, *Shaping Technology/Building Society*, 3

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- ²⁸ Langdon Winner, "Do Artefacts Have Politics?," *Daedalus*, vol. 109, no. 1 (1980), 128.
- ²⁹ Bijker and Law, *Shaping Technology/Building Society*, 3.
- ³⁰ John Tomasi, *Free Market Fairness* (Princeton: Princeton University Press, 2012).
- ³¹ Lamont, "Toward a comparative sociology of valuation."
- ³² William H. Sewell, "Ideologies and Social Revolutions: Reflections on the French Case," *The Journal of Modern History* vol. 57, no. 1 (1985), 60.
- ³³ John Locke, *Two Treatises of Government* (Cambridge: Cambridge University Press, 2010), 330.
- ³⁴ Consider C.B. Macpherson's account of Hobbes' early liberal theory: "The state may control land use and labour use, may interfere with the free flow of trade by embargoes and customs duties, may assist one kind of industry and discourage another, may provide free or subsidized services, may relieve the destitute [...] and may by these and other kinds of interference prevent prices (and wages) reaching the levels which an unregulated or less regulated market would produce." C.B. Macpherson, *The Political Theory of Possessive Individualism, Hobbes to Locke* (Oxford: Oxford University Press, 2011), 58.
- ³⁵ Tomasi, *Free Market Fairness*, 7.
- ³⁶ Frederick von Hayek, *The Road to Serfdom* (London: Routledge, 2005), 125.
- ³⁷ Macpherson, *The Political Theory of Possessive Individualism*.
- ³⁸ Ronald Dworkin, *Sovereign Virtue* (Cambridge: Harvard University Press, 2002), 31.
- ³⁹ Tomasi, *Free Market Fairness*, 42.
- ⁴⁰ Paul Kelly, "Justifying 'justice': contractarianism, communitarianism and the foundations of contemporary liberalism," in David Boucher and Paul Kelly, *The Social Contract from Hobbes to Rawls* (London: Routledge, 1994).
- ⁴¹ Dworkin, *Sovereign Virtue*, 66.
- ⁴² Consider, e.g. Hal Varian, "Equity, Envy, and Efficiency," *Journal of Economic Theory* vol. 9 (1974), 63-91.
- ⁴³ Tomasi, *Free Market Fairness*, 45.
- ⁴⁴ Kelly, "Justifying 'justice'," 5-6.
- ⁴⁵ Tomasi, *Free Market Fairness*, 48.
- ⁴⁶ E.g. Nozick's argument on voluntary slavery. See Robert Nozick, *Anarchy, State, and Utopia* (New York: Basic Books, 1977).
- ⁴⁷ Tomasi, *Free Market Fairness*, 47.
- ⁴⁸ Paul Schumaker, *From Public Ideologies to Public Philosophies* (New York: Wiley-Blackwell, 2008).
- ⁴⁹ See Anne M. Khademian, *The SEC and Capital Market Regulation* (Pittsburg: University of Pittsburg Press; 1992).
- ⁵⁰ Khademian, *The SEC and Capital Market Regulation* 57-82.
- ⁵¹ Yuval Millo, "Creation of a market network: the regulatory approval of the Chicago Board Options Exchange (CBOE)" *ESRC Centre for Analysis of Risk and Regulation Discussion Paper* no. 23 (2004), 5. Also, Khademian, *The SEC and Capital Market Regulation*.
- ⁵² *Report of the Special Study of the Securities Markets of the Securities and Exchange Commission*, 88th Congress, 1st Session (1963), House Doc. No. 95, Pt. 7, p. 657-8.
- ⁵³ *Special Study*, Pt. 7, 668.

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- ⁵⁴ Wyatt Wells, "Certificates and Computers: the Remaking of Wall Street, 1967 to 1971," *The Business History Review* vol. 74, no. 2 (2000): 193-235.
- ⁵⁵ *Federal Legislation to Enhance Competition in the Securities Industry*, 16 William and Mary Law Review, vol. 621 (1975), 641.
- ⁵⁶ *Institutional Investor Study Report of the Securities and Exchange Commission*, 92nd Congress, 1st Session (1971), House Doc. No. 92-64, Part 8, p. xxv.
- ⁵⁷ As proposed by the NYSE in the so-called *Martin Report* of 1971.
- ⁵⁸ Bruno Latour, "Why has critique run out of steam? From matters of fact to matters of concern," *Critical Inquiry* vol. 30 (Winter, 2004): 225-248.
- ⁵⁹ The SEC's emphasis on market efficiency, perhaps associated to the rise of financial economics in the late 1960s, is analyzed by Donald Langevoort, "Theories, assumptions and securities regulation: market efficiency revisited," *University of Pennsylvania Law Review* vol. 104, no. 3 (1992): 851-920.
- ⁶⁰ *Study of the Securities Industry*, 92nd Congress, 1st Session, House Doc. No. 92-37, Pt. 3.
- ⁶¹ Karl Polanyi, *The Great Transformation: the Political and Economic Origins of Our Time* (Boston: Beacon Press, 2001). See also Margaret Somers and Fred Block, "From poverty to perversity: ideas, markets, and institutions over 200 years of welfare debate," *American Sociological Review* vol. 70, no. 2 (2005): 260-287.
- ⁶² James Mahoney, "Path Dependence in Historical Sociology," *Theory and Society* vol. 29, no. 4 (2000): 507-548.
- ⁶³ *Securities Acts Amendments of 1975*, Public Law 94-29, 94th Congress, 1st Session (June 4, 1975).
- ⁶⁴ Khademian, *The SEC and Capital Market Regulation*, 76.
- ⁶⁵ The development of the ITS and consolidated tapes is discussed in Daniel Beunza and Yuval Millo, "How regulators and economists shaped the US automated financial exchanges," Unpublished manuscript, London School of Economics and Political Science.
- ⁶⁶ Robert Colby, Lloyd Feller, Mark Fitterman, and George Simon, "The National Market System: a Selective Outline of Significant Events," Unpublished manuscript.
- ⁶⁷ Weeden interview, SEC Historical Society, 4 November 2010, by Kenneth Durr.
- ⁶⁸ National Market Advisory Board, *Report to the Securities and Exchange Commission from the National Market Advisory Board*, (Washington, D.C., 1977) 1977.
- ⁶⁹ *Securities Acts Amendments of 1975*
- ⁷⁰ National Market Advisory Board, *Report*.
- ⁷¹ Marion Fourcade and Kieran Healy, "Classification situations: life-chances in the neoliberal era," *Accounting, Organizations and Society*, vol. 38 (2013): 559-572; Latour, "Why has critique run out of steam?"
- ⁷² Lawrence Arnold, "Junius Peake, Early Advocate of Electronic Securities Trading, Dies at 80," *BloombergBusinessWeek* (February 13, 2012), accessed on 22 March 2012, <http://www.businessweek.com/news/2012-02-14/junius-peake-early-advocate-of-electronic-trading-dies-at-80.html>
- ⁷³ *Securities Industry Study*, 92nd Congress, 1st Session (1971), House Doc. No. 92-37, Pt. 2.

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- ⁷⁴ Along with Morris Mendelson, Professor of Finance at Wharton School, University of Pennsylvania, and R.T. Williams, in 1976 Peake submitted to the NMAB the proposal of
- ⁷⁵ Khademian, *The SEC and Capital Market Regulation*, 74.
- ⁷⁶ Peake in Robert Schwartz, John Aidan Byrne and Antoinette Colaninno, *Call Auction Trading: New Answers to Old Questions* (Boston: Kluwer Academic Publishers, 2003), 90.
- ⁷⁷ Junius Peake, “The national market system,” *Financial Analysts Journal* vol. 34, no. 4 (1978), 25
- ⁷⁸ Peake, “The national market system”, 28.
- ⁷⁹ See, for instance, Commissioner Milton Cohen’s discussion of trading systems similar to Peake’s. Milton Cohen, “The National Market System—A Modest Proposal,” *George Washington Law Review* vol. 46 no. 5 (1978): 743-789.
- ⁸⁰ This was arguably related to Peake’s experience with NASD, built in sharp contrast to ‘closed’ membership of the NYSE.
- ⁸¹ *Progress toward the development of an NMS, 1979*
- ⁸² *Study of the Securities Industry*, Pt. 6, 3395.
- ⁸³ *Study of the Securities Industry*, Pt. 7, 95.
- ⁸⁴ Dworkin, *Sovereign Virtue*.
- ⁸⁵ NYSE had support: with the exception of NASD, all self-regulatory organizations opposed hard CLOB up to 1979 and made clear their preference for ITS.
- ⁸⁶ Securities and Exchange Commission, *Market 2000: an Examination of Current Equity Market Developments* (Washington, D.C.: SEC Division of Markets Regulation, 1994).
- ⁸⁷ SEC, *Market 2000*, AII-12
- ⁸⁸ Schaible in *Market 2000*, AII-12
- ⁸⁹ SEC, *Market 2000*, iv.
- ⁹⁰ See Bellafiore, quoted in Donald MacKenzie and Juan Pablo Pardo-Guerra, “Insurgent Capitalism: Island, Bricolage, and the Re-making of Finance,” *Economy and Society* (2014). See also William Christie and Robert Thomson, “Wall Street Scandals: the Curative Effect of Law and Finance,” *Washington University Law Review* vol. 84, no. 7 (2006): 1567-1590.
- ⁹¹ *Competition in the New Electronic Market*, 106th Congress, Second Session (2000), House Doc. No. 106,111.
- ⁹² Foley, in *Competition in the New Electronic Market*, 14.
- ⁹³ Smith in Schwartz et al. *Call Auction Trading*, 87.
- ⁹⁴ Andresen, in *Competition in the New Electronic Market*, 6.
- ⁹⁵ *Regulation NMS*, Securities and Exchange Commission, 2005, 34-51808 (June 9, 2005).
- ⁹⁶ Wunsch in Schwartz et al. *Call Auction Trading*, 105. See also Fabian Muniesa, “Is a stock exchange a computer solution? Explicitness, algorithms and the Arizona Stock Exchange,” *International Journal of Actor Network Theory and Technological Innovation*, vol. 3 no. 1 (2011): 1-15.
- ⁹⁷ Emphasis added. Wunsch in Schwartz et al. *Call Auction Trading*, 91.
- ⁹⁸ Gerald Putnam, founder of ECN Archipelago, in Schwartz et al. *Call Auction Trading*, 88.

⁹⁹ Frank Dobbin, *Inventing Equal Opportunity* (Princeton: Princeton University Press, 2009).

¹⁰⁰ As one SEC lawyer recognized, the statutory objectives of NMS are “wide... and subject to broad interpretation.” In Khademian, *The SEC and Capital Market Regulation*, 77.

¹⁰¹ James Burk, *Values in the Marketplace: The American Stock Market Under Federal Securities Law* (New York: Aldine de Gruyter, 1992), 132.

¹⁰² Recent work in cultural sociology highlights similar transitions and shifts in societal ‘models’ of consumption. See Jeremy Schulz and Laura Robinson, “Shifting grounds and evolving battlegrounds: evaluative frameworks and debates about market capitalism from the 1930s through the 1990s,” *American Journal of Cultural Sociology* vol. 1, no. 3 (2013): 373-402.

¹⁰³ Stephanie Mudge, “What is Neo-Liberalism?,” *Socio-Economic Review* vol. 6, no. 4 (2008), 703-731.

¹⁰⁴ John Campbell and Ove Pedersen, *The Rise of Neoliberalism and Institutional Analysis* (Princeton, Princeton University Press, 2001), 1-17.

¹⁰⁵ Mudge, “What is Neo-Liberalism?”

¹⁰⁶ Bruno Amable, “Morals and politics in the ideology of neo-liberalism,” *Socio-Economic Review* vol. 9, no. 1, 3-30.