Law's Acceleration of Finance: Redefining the Problem of High-Frequency Trading

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High-frequency traders automate stock trading, placing thousands of orders over fractions of a second. Their algorithmic strategies are all too often mere rule manipulation or methods of using brute speed to gain advantages over rivals. Normative evaluation of finance's algorithms must take into account the sector's social function: to spur efficient, fair, and sustainable investment practices. The complex modeling deployed in high-frequency trading does not reliably contribute to these goals. Therefore, rather than straining to accommodate high-frequency trading strategies, regulators should eliminate many of them.

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INTRODUCTION

With the publication of Michael Lewis's book *Flash Boys*, the computerization of finance has finally entered the limelight.[1] Lewis's bombshell book accused high technology traders (and complicit exchanges) of rigging the stock market.[2] Though concerns about misuse of technology had been growing for years, mass media attention spurred a flurry of regulatory activity.[3] Cases against leading firms and "dark pools" are now pending, and Congress has investigated trading practices.[4] Regulators are aiming to separate the wheat from the chaff, permitting legitimate forms of high-frequency trading (HFT), while punishing or effectively prohibiting more destructive forms.[5]

Unfortunately, current policy responses to HFT are unlikely to improve capital markets significantly. Legal commentary on HFT suffers from a fundamental misconception about the nature of the relationship between law and finance.[6] Whereas most legal commentators assume that the technology of finance is independent of legal rules, such rules are in fact a prime driver of technological developments in finance. The literature on HFT also tends to assume

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[1] MICHAEL LEWIS, FLASH BOYS: A WALL STREET REVOLT (2014). Lewis made more accessible an argument pioneered by Scott Patterson, Sal Arnuk, and Joseph Saluzzi. SAL ARNUK & JOSEPH SALUZZI, BROKEN MARKETS: HOW HIGH-FREQUENCY TRADING AND PREDATORY PRACTICES ON WALL STREET ARE DESTROYING INVESTOR CONFIDENCE AND YOUR PORTFOLIO (2012); SCOTT PATTERSON, DARK POOLS: HIGH SPEED TRADERS, AI BANDITS, AND THE THREAT TO THE GLOBAL FINANCIAL SYSTEM (2012) (discussing quants who pioneered early algorithmic trading, and came to see its later development as predatory).

[2] LEWIS, *supra* note 1, at 265–66. High-frequency trading (HFT) is the use of computer algorithms to rapidly place, modify, or cancel orders, often in just fractions of second. IRENE ALDRIDGE, HIGH-FREQUENCY TRADING: A PRACTICAL GUIDE TO ALGORITHMIC STRATEGIES AND TRADING SYSTEMS 13 (2013) (discussing definition used by the Commodity Futures Trading Commission).

[3] *See* John McCrank, *Exclusive: SEC Targets 10 Firms in High-Frequency Trading Probe – SEC Document*, REUTERS (July 17, 2014, 5:19 PM), http://www.reuters.com/article/2014/07/17/us-sec-investigation-highfrequencytradin-idUSKBN0FM2TW20140717.

[4] *Conflicts of Interest, Investor Loss of Confidence, and High Speed Trading in U.S. Stock Markets Before the S. Permanent Subcomm. on Investigations*, 113th Cong. (2014) (testimony of Bradley Katsuyama, President and CEO of IEX Group).

[5] Concept Release on Equity Market Structure, Exchange Act Release, 75 Fed. Reg. 3594, 3606 (Jan. 21, 2010) (to be codified at 17 C.F.R. pt. 42).

[6] In a nutshell, the regulators are letting the worst aspects of the technology shape their approach, rather than trying to limit them. Marc Lenglet, *Conflicting Codes and Codings: How Algorithmic Trading is Reshaping Financial Regulation*, 28 THEORY CULTURE & SOC'Y 44, 47–48 (2011).

without proving that the primary goal of the financial system is to promote liquidity—that is, to assure that equities can be bought and sold in the fastest, most expeditious manner possible. This, too, is a problematic assumption, because sometimes a financial system can do far more to facilitate real productivity and economic stability when it puts some friction into exchange and encourages long-term investment. There is no necessary relationship between the overall wisdom of capital allocation in a society and its enabling ever-decreasing time commitments to investment.[7]

Policymakers' failure to recognize that finance is endogenous to law, and that liquidity is only one of many values in a financial system, has distorted legal scholarship on HFT. Leading scholars' primary concern is whether regulators can keep up with the technology of the high-frequency traders.[8] They should be examining how regulation itself incentivized the development of millisecond-level trading technology, and could in the future reduce (or even eliminate) its appeal. Moreover, the finance law scholarship program of fine-tuning the practices of extant public exchanges (and dark pools) misses a critical problem with equity trading: its short termism.[9] Management teams and boards at publicly traded companies will become less likely to make important, long-term investments when stock prices are increasingly driven by short run trading dynamics.

Fortunately, an emerging approach to financial affairs, known as the "Legal Theory of Finance" (LTF), offers illumination here, and should guide future policy interventions.[10] An interdisciplinary research team of social scientists and attorneys, led by Columbia Law Professor Katharina Pistor, has documented the ways in which law is *constitutive* of financial markets. Revitalizing the tradition of legal realism in finance, Pistor has demonstrated the critical role of law in creating and maintaining durable exchanges of equity and debt. Though law to some extent shapes all markets, in finance it is fundamental—the "products"

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[7] MARY MELLOR, THE FUTURE OF MONEY: FROM FINANCIAL CRISIS TO PUBLIC RESOURCE 5 (2010); ADAIR TURNER ET AL., THE FUTURE OF FINANCE: THE LSE REPORT 14 (2010).

[8] Tara Bhupathi, *Technology's Latest Market Manipulator? High Frequency Trading: The Strategies, Tools, Risks, and Responses*, 11 N.C. J.L. & TECH. 377 (2010); Charles R. Korsmo, *High-Frequency Trading: A Regulatory Strategy*, 48 U. RICH. L. REV. 523, 595 (2014) ("With novel technology . . . the harms involved and the best methods for avoiding them are unlikely to be fully understood with any great confidence. Without significant experience, it may not be possible to develop efficient and effective ex ante regulations." (footnotes omitted)); Tom C.W. Lin, *The New Investor*, 60 UCLA L. REV. 678, 717 (2013) ("Law constantly plays tortoise to finance's hare.").

[9] Lynne L. Dallas, *Short-Termism, the Financial Crisis, and Corporate Governance*, 37 IOWA J. CORP. L. 265 (2012).

[10] Katharina Pistor, *A Legal Theory of Finance*, 41 J. COMP. ECON. 315, 317 (2013).

traded are very little more than legal recognitions of obligations to buy or sell, own or owe.[11]

The LTF changes the debate, which can now move beyond stale dichotomies like "law vs. technology," or "state vs. market." As Pistor shows, "financial markets are rule-bound systems" and "finance is essentially hybrid between state and markets, public and private."[12] The LTF also enables a more substantive dialogue about the purpose of finance, beyond merely increasing the speed, efficiency, and accuracy of trading. Once we acknowledge that public resources are the critical foundation of modern finance, we can begin to re-instill it with *public purpose*. Here, another branch of thought about finance—mainly arising out of the work of economists like Mary Mellor, Geoff Mulgan, Ann Pettifor, and Mariana Mazzucato—should inform American debate.[13] Their *substantive* approach to finance, focusing on the most productive deployment of capital, is a necessary corrective to decades of *procedural* focus in U.S. law.[14]

This Article redefines the problem of HFT through the twin lenses of the LTF and substantive guidance of investment. The common mental picture of hapless, outmatched regulators contending with technical expertise beyond their comprehension is misleading. First, it was regulators who changed the rules and sparked the rapid growth of HFT technologies.[15] Second, regulators' lack of resources is not simply the natural state of affairs—rather, it is one intensively pursued by lobbyists who influence the relevant Congressional committees to cut appropriations, and to prevent agencies like the Securities Exchange Commission (SEC) and Commodity Futures Trading Commission (CFTC) from keeping the billions of dollars they effectively earn by policing markets and imposing fines.[16] The relevant regulators could

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[11] ROSCOE POUND, JURISPRUDENCE 163–64 (1959) ("In a commercial age wealth is largely made up of promises.").

[12] *See* Pistor, *supra* note 10, at 312 (discussing the four key components of the legal theory of finance).

[13] *See* MELLOR, *supra* note 7; *see also* MARIANA MAZZUCATO, THE ENTREPRENEURIAL STATE: DEBUNKING PUBLIC VS. PRIVATE SECTOR MYTHS (2014); GEOFF MULGAN, THE ART OF PUBLIC STRATEGY: MOBILIZING POWER AND KNOWLEDGE FOR THE COMMON GOOD (2009); ANN PETTIFOR, JUST MONEY: HOW SOCIETY CAN BREAK THE DESPOTIC POWER OF FINANCE (2014).

[14] An excellent recent article has begun this process of translation. Robert C. Hockett & Saule T. Omarova, *Public Actors in Private Markets: Toward a Developmental Finance State*, 93 WASH. L. REV. (forthcoming 2015).

[15] One critical development was the implementation of aspects of Regulation NMS (National Market System). *See, e.g.*, Dissemination of Quotations in NMS Securities, 17 C.F.R. § 242.602 (2013); Disclosure of Order Execution Information, 17 C.F.R. § 242.605 (on making order execution information available); Access to Quotations, 17 C.F.R. § 242.610; PATTERSON, *supra* note 1, at 49 (discussing Reg. NMS's effects on trading venues' monitoring of prices).

[16] In other agencies of government, like the Centers for Medicare and Medicaid Services (CMS), law enforcers can keep some of the money they collect in fines, in part in order to invest in better ways of detecting and deterring fraud in the future. Frank A. Pasquale, *Private Certifiers and Deputies in American Health Care*, 92 N.C. L. REV. 1661, 1667 (2014).

always go back and undo or alter the rules that make milliseconds matter in trading. Congress could empower regulators to do more to deter misuses of latency—i.e., the delays in transmission between certain orders and their execution. A tax as small as a tenth of a penny per trade could effectively end most HFT. Rather than taking the current rules and technological capabilities of law enforcement as the given baseline for discussions of HFT, we should instead view them as the prime *targets* of reform.

To make that case, Part I describes the rise of HFT, and the distortions, biases, and unfair advantages it creates in current markets. Part II addresses the current law of trading, analyzing efforts by federal and state regulators (and private litigants) to challenge particularly manipulative or troubling application of technology by HFT firms and the exchanges and dark pools used by them. Part III discusses how to make current regulatory initiatives more effective. It also shows how policy that is more substantive in orientation than current approaches could promote both efficiency and fairness.[17] Part IV concludes with reflections on how the LTF and substantive goals for financial regulation could reshape finance policy more generally.

I.   THE ACCELERATION OF FINANCE

By the 1990s, pioneer automators were pushing stock and commodities trading away from physical exchanges and "out of the pits" in order to squeeze out middlemen and narrow the "bid-ask" spread in any given trade.[18] The algorithmic tools deployed in all these scenarios did indeed reduce some inefficiencies, and knocked now-vestigial middlemen out of the industry. Yet they have also had many troubling consequences. Section A below describes the rise of HFT, and the nature of the trading it enables. Section B describes the problems that HFT creates, focusing on the ways in which the practice of high speed algorithmic trading engenders problems bigger than those it ostensibly solves.

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[17] For definitions of efficiency and fairness, see Chris William Sanchirico, *Taxes Versus Legal Rules as Instruments for Equity: A More Equitable View*, 29 J. LEGAL STUD. 797 (2000).

[18] *See* CAITLIN ZALOOM, OUT OF THE PITS: TRADERS AND TECHNOLOGY FROM CHICAGO TO LONDON (2006); Donald MacKenzie & Juan Pablo Pardo-Guerra, *Insurgent Capitalism: Island, Bricolage and the Re-making of Finance*, ECON. & SOC'Y, May 2014, at 5, *available* at http://www.sps.ed.ac.uk/__data/assets/pdf_file/0003/97500/Island34.pdf ("Island exemplified a specific thread within computer programming in the United States: 'hacker' culture. . . . This was and is libertarian . . . committed to opening up technologically or socially closed systems, and hostile to over-restrictive forms of intellectual property.").

A. *Defining High-Frequency Trading*

Modern equity markets are very complex.[19] Whereas trading was once done by actual human beings, the majority of trading today is done by sophisticated computers running complex algorithms (commonly referred to as algorithmic trading).[20] For example, consider what happens when an investor logs into an account at a brokerage to place an order (all within a second, given automation).[21] The broker will sometimes send the trade to wholesalers.[22] As of 2012, these wholesalers could "internalize" about a fifth of trades, matching them with their own internal orders.[23] The rest of the trades are sent out to two types of trading venues: public exchanges and dark pools.[24]

Public exchanges must display prices openly and have other obligations to customers.[25] As of early 2013, seven companies were operating thirteen public exchanges.[26] Dark pools, by contrast, are more numerous and opaque.[27] Handling about thirteen percent of orders, they are favored by traders who do not want news of their activities to be disseminated (too quickly) to other traders.[28]

Why does secrecy matter? Consider, for instance, a trader who wanted to buy a sizeable portion of shares at each hour of the day, from

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[19] This paragraph and the next two rely on the diagram that is part of Matthew Philips & Cynthia Hoffman, *How Your Buy Order Gets Filled*, BLOOMBERG.COM (Dec. 20, 2012), http://www.bloomberg.com/bw/articles/2012-12-20/how-your-buy-order-gets-filled (illustrating that transactions are no longer straightforward and can take a variety of paths).

[20] Trades are essentially contracts, and can be rendered computable by translation into programs. Harry Surden, *Computable Contracts*, 46 U.C. DAVIS L. REV. 629, 635 n.19 (2012) ("Colloquially, the term 'computable' is used when a computer can be given the means to produce a desired result (such as a mathematical computation)."); *see also* Tor Brunzell, *High-Frequency Trading—To Regulate Or Not to Regulate—That Is the Question*, 2 J. BUS. & FIN. AFF., no. 1, 2013, *available at* http://omicsgroup.org/journals/high-frequency-trading-to-regulate-or-not-to-regulate-that-is-the%20question-does-scientific-data-offer-an-answer-2167-0234.1000e121.pdf ("It is estimated that HFT accounts for two-thirds (perhaps, even three-quarters) of equity trading in the US, and about one-third of the equity trading in Europe."); MacKenzie & Pardo-Guerra, *supra* note 18, at 34 ("Only a very small minority of deals are now consummated by human beings: the heart of trading is tens of thousands of computer servers . . . carrying millions of messages a second."); Graham Bowley, *Clamping Down on Rapid Trades in Stock Market*, N.Y. TIMES, Oct. 8, 2011, http://www.nytimes.com/2011/10/09/business/clamping-down-on-rapid-trades-in-stock-market.html ("[High-frequency] trading . . . now accounts for two of every three stock market trades in America.").

[21] Philips & Hoffman, *supra* note 19.

[22] *Id.*

[23] *Id.*

[24] *Id.*

[25] *Id.*

[26] *Id.*

[27] PATTERSON, *supra* note 1, at 342 (2013); Philips & Hoffman, *supra* note 19.

[28] PATTERSON, *supra* note 1, at 202 (traders are "exploiting the 'latency' of the system, a measurement of the time it takes for information to move from place to place"); Philips & Hoffman, *supra* note 19.

10:00 a.m. to 3:00 p.m. If rival traders learned of that strategy at 10:30 a.m., they might buy shares ahead of the sequential purchases, knowing the later purchases would drive up demand (and thus price). They could then make a quick profit by selling the shares to the sequential purchaser. Instead of seeing shares rise *after* his purchases, he'd see them rise *before.* His action may well be the primary reason for the rise, but the profits for it would go to the people who traded ahead of him. By contrast, imagine if the news of the sequential purchases breaks the next day. At that point, markets may interpret the buys as a sign of the strength of the company offering the shares. In that scenario, the sequential purchaser gets to keep the gains attributable to his own "vote of confidence" in the shares. It is all a matter of timing.

Those in favor of ever HFT (and ever more granular measures of the time of the placing of bids and asks) argue that no trader "deserves" to reap the benefits of leading or spurring investment in an equity merely by being first.[29] They shed no tears for the sequential trader effectively scooped by anticipatory algorithms. Yet that same logic should apply a fortiori to their own activity. The question of where any gains from trading go is at bottom one of policy, not pure economic theory. The markets can be structured to neutralize any given party's advantage; the real question is whether proactive structuring by any given market or regulator substantially diminishes *economic productivity,* not liquidity.

Computer programs now execute a sizeable portion of daily transactions.[30] The time frame has narrowed, and there are plenty of opportunities to gain a temporarily hidden advantage. The *Wall Street Journal* exposed a simple example involving sneak peeks at important reports. Algorithms parse major news stories the moment they "break" online, instantly dispatching buy or sell orders (when, say, the words "Pfizer" and "lawsuit" or "breakthrough drug" appear in the same paragraph).[31] Reports can easily move markets. By paying for early access to the data, sometimes as little as two seconds, traders beat rivals

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[29] The "bid" is the highest price a buyer will pay to buy a specified number of shares of stock at a given time. The "ask" is the lowest price at which a seller will sell the stock. U.S. SEC. & EXCHANGE COMMISSION, *Fast Answers: "Bid" Price*, http://www.sec.gov/answers/bid.htm (last visited May 31, 2015).

[30] Algorithmic trading refers to the use of computers to place orders on equities markets while using algorithmic codes to decide the specific aspects of the order, such as the timing, price, and quantity, all without any human intervention. Nathan D. Brown, *The Rise of High-Frequency Trading: The Role Algorithms, and the Lack of Regulations, Play in Today's Stock Market*, 11 APPALACHIAN J. L. 209 (2012). Algorithmic codes are typically proprietary and secret. *Id.* at 222.

[31] Predictive analytics can use massive data sets to develop pattern recognition of what happened to prices after a given word appeared in key news sources. The same technology is affecting many businesses. *See, e.g.,* Malcolm Gladwell, *The Formula*, NEW YORKER, Oct. 16, 2006, at 139 (noting that Epagogix software can predict the success of screenplays based on content analysis of word usage and structure).

who assumed they were all on a level playing field.[32] One of the most egregious examples of the unfair use of early information involves nongovernmental organizations giving HFT firms early access to potentially market-moving data. Some HFT firms have paid anywhere from a few thousand dollars a year to thousands of dollars per month for the early access.[33]

Other HFT firms take advantage of early information by engaging in order discovery strategies, also known as "whale hunting."[34] The trader "pings" the market with multiple orders in an attempt to detect the presence of a market participant with a large position who is in the process of accumulating or liquidating its holding (often a mutual fund).[35] The trader would then purchase the stock hoping to profit from the expected price increase or decrease.[36]

Of course, buying early access to data streams is in some ways a self-defeating project—as soon as it is exposed, smart traders may stop using the data altogether as a prompt to trading. Or they may up the ante, and try to outwit the early-data buyers at their own game. How might that work? The key is the fragmentation of markets for stocks, and superfast communication technology. Let's say one trader's bots put in a buy order for 5000 shares of Pfizer at $100 a share after parsing a report with the words "Pfizer" and "breakthrough" in it at 9:54:58 a.m. (fifty-eight seconds after 9:54 a.m., and two seconds before the story is made public). That order *itself* may be a kind of news to other traders, once it is transmitted to their terminals. If someone else's bots can process a trade before the early trader can, they can beat him to the punch. And just as the early trader paid for a peek at the news report before others saw it, a flash trader may pay the early trader's exchange to find out *immediately* when the order has been placed.

HFT allows transactions to occur in fractions of a second.[37] In the example above, one trader may manage to grab the shares at 9:54:58:100 a.m. (fifty-eight seconds and 100 milliseconds—thousandths of a second—9:54 a.m.). There are at least two types of information

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[32] Brody Mullins et al., *Traders Pay for an Early Peek at Key Data*, WALL ST. J., June 12, 2013, http://www.wsj.com/articles/SB10001424127887324682204578515963191421602.

[33] *Id.* For a critical legal analysis of the role of queueing in law, see Ronen Perry & Tal Z. Zarsky, *Queues in Law*, 99 IOWA L. REV. 1595, 1629 (2014).

[34] Wallace C. Turbeville, *Cracks in the Pipeline 2: High Frequency Trading*, DĒMOS 11 (Mar. 8, 2013), http://www.demos.org/sites/default/files/publications/HFT_CracksInThePipeline_ Demos.pdf.

[35] *Id.*

[36] *Id.*

[37] Brown, *supra* note 30, at 209–10; Brunzell, *supra* note 20 (discussing the common arguments proponents of HFT make supporting its use). There is a range of algorithmic trading strategies; HFT describes one subset of these strategies. David Golumbia, *High-Frequency Trading: Networks of Wealth and the Concentration of Power*, 23(2) SOCIAL SEMIOTICS 278, 284 (2013).

advantage deployed here. First, high-frequency traders are profiling pending orders on exchanges to try to detect likely price movements milliseconds before they occur. They can do so by paying for direct "data feeds" from public exchanges.[38] Such direct feeds convey information faster to paid subscribers than they do to the Securities Information Processor (SIP), which is the standard report of trading activity (such as posted bids and offers) at an exchange.[39] When a high-frequency trader can obtain information on likely trades before (most of) the rest of the market, he can engage in "latency arbitrage"—that is, take advantage of a temporary knowledge advantage to anticipate where the market is going (even if the price movement is very slight) and act accordingly.[40]

The strategies of HFT are supercharged by big data. They require the use of past patterns of trading to predict the future. Consider, for instance, how weather forecasting can be almost impossible two weeks out, but almost certain over a time span of minutes or hours, given contemporary models and monitoring of weather patterns.[41] So too can the prediction of momentary market moves in response to, say, an order for 100,000 shares of a stock be near-certain (even if we still have far less sense of where the stock will be in two weeks).[42]

HFT strategy depends entirely on information advantage—knowing something (or algorithmically decoding some signal) before everyone else does.[43] Lately, the limiting factor in fast trading is not computing power, but communication power. Thus firms are paying to construct ultrafast cables between financial centers.[44] Spread Networks

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[38] Scott Patterson & Jenny Strasburg, *For Superfast Stock Traders, a Way to Jump Ahead in Line*, WALL ST. J. (Sept. 12, 2012, 5:59 PM), http://www.wsj.com/articles/SB10000872396390443989204577599243693561670.

[39] ARNUK & SALUZZI, *supra* note 1. See generally What Is SIP and What Role Should It Play, MOD. MARKET INITIATIVES (Jan. 16, 2014), http://modernmarketsinitiative.org/sip-role-play. Some critics have argued that HFT traders getting faster quotes through direct feeds is illegal. *See Nanex~22-Aug-2013~Amazon's 2.5 Minute Outage at 11:01*, NANEX RES., http://www.nanex.net/aqck2/4398.html ("[E]xchanges are providing data to High Frequency Traders via direct feeds ahead of the SIP or consolidated feed. This is a clear violation of Reg NMS . . . . In fact, this behavior renders Reg NMS moot.").

[40] Latency arbitrage "involves trading in the sub-second time windows between when market prices move and when market makers update their quoted prices." Matt Prewitt, Note, *High-Frequency Trading: Should Regulators Do More?*, 19 MICH. TELECOMM. & TECH. L. REV. 131, 136 (2012).

[41] *Predicting the Weather: Forecasting*, NAT'L CENTER FOR ATMOSPHERIC RES., http://www.eo.ucar.edu/basics/wx_4.html (last visited May 31, 2015).

[42] See generally What is SIP and What Role Should It Play, *supra* note 39.

[43] HFT often involves "very high order amounts; rapid order cancellation; a flat position at the end of the trading day; extracting very low margins per trade; and trading at ultra-fast speeds." Andrew J. Keller, Note, *Robocops: Regulating High Frequency Trading after the Flash Crash of 2010*, 73 OHIO ST. L.J. 1457, 1459 (2012).

[44] For example, McCabe observes, a "Chicago-New York cable will shave about 3 milliseconds off . . . communication time." Thomas McCabe, *When the Speed of Light Is Too Slow: Trading at*

spent over $200 million to lay a cable between Chicago and New York-area exchanges, estimating that firms could make $20 billion in a year exploiting price discrepancies (lasting less than a second) between the two cities.[45] Modelers have devised more extreme solutions to the time delay problem. An "optimal scheme" would "push trading firms to build new computers [at] the exact, optimal points in between markets"— even if that happened to be in the middle of an ocean.[46]

B.   *Evaluating High-Frequency Trading*

Before addressing the legal and economic theory specific to finance, it is helpful to consider the problem of HFT from another perspective: that of rank ordering in a competition. Consider, for instance, a school that wants to name a valedictorian, and finds that the top two grade point averages are 3.94645 (Bob's) and 3.94646 (Ann's). If the rule established beforehand is "the valedictorian is the person with the highest GPA," Ann is the obvious choice. However, if the school had clarified that GPAs were rounded to the second decimal place, the two tie for co-valedictorian, with GPAs of 3.95. I take no position on whether either is the more desirable outcome (though I am deeply skeptical that a 0.00001 point difference is in any way a reliable indicator of the relative intelligence or work ethic of the two students). I just want to observe that, when it comes to such fine-grained differentiations, *either* rule can be plausibly chosen: to make a ten-thousandth of a point, or even a billionth of a point, count, or to decide via rounding to limit the number of significant figures in the determination.[47]

A similar logic should guide our treatment of HFT. Though the determination of common, precise standards of time has been a hallmark of scientific and technological advance, its value to systems of buying and selling is always relative to the social purpose of those systems.[48] There is no inherent virtue in being able to measure the time that a trade is placed and submitted in either thousandths, millionths, billionths, or quadrillionths of a second. HFT advocates may say that,

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the Edge, KURZWEIL ACCELERATING INTELLIGENCE BLOG (Nov. 11, 2010), http://www.kurzweilai.net/when-the-speed-of-light-is-too-slow.

45 LEWIS, *supra* note 1, at 15. Economic sociologists have also studied Spread Networks. Donald MacKenzie et al., *Drilling Through the Allegheny Mountains: Liquidity, Materiality and High-Frequency Trading*, 5 J. CULTURAL ECON. 279, 285 (2012), *available at* http://www.sps.ed.ac.uk/__data/assets/pdf_file/0003/78186/LiquidityResub8.pdf.

46 *See* McCabe, *supra* note 44 (internal quotation marks omitted); *see also* A. D. Wissner-Gross & C. E. Freer, *Relativistic Statistical Arbitrage*, 82 PHYSICAL REV. E 056104-1 (2010).

47 Perry & Zarsky, *supra* note 33, at 1635.

48 PETER GALISON, EINSTEIN'S CLOCKS AND POINCARE'S MAPS: EMPIRES OF TIME (2003); DAVA SOBEL, LONGITUDE: THE TRUE STORY OF A LONE GENIUS WHO SOLVED THE GREATEST SCIENTIFIC PROBLEM OF HIS TIME (2007).

without finer demarcations of time, they are stuck deciding what to do with, say, two orders that both come in at 10:00:01 a.m. for a set sale of the only 100 shares of stock available that day. Knowing that one came in at 10:00:01:001 a.m. and the other at 10:00:01:002 a.m. allows the shares to be allocated to the first purchaser. But the rule could just as easily be set to choose, at random, one order to allocate the shares to. Another possibility is to divide them evenly, or to offer each bidder the chance to rebid within one hour. Once the rule is set, traders adapt. All of these methods can be translated into the high technology of contemporary finance.

In short, technology does not necessarily drive markets toward the goal of ever-faster trading. The social practice of buying and selling stocks is fundamentally malleable, and technology makes it ever more malleable.[49] As Travis Breaux has shown, the computation of "terms of use" online makes possible extraordinarily detailed and diverse set of privacy preferences to be chosen by consumers and businesses.[50] Moreover, "computable contracts" have a long history in finance and could be applied here.[51] Contemporary trading is never merely a spontaneous order of voluntary exchanges. It is always already a co-creation of markets and states.[52] The only way trading happens is because an intricate set of rules governs and defines nearly all aspects of the consequences of placing an order, cancelling the order, denying or delaying the fulfillment of an order, among myriad other possibilities. Without those rules, the "market" would grind to a halt. As the LTF shows, there is no sophisticated contemporary financial trading system outside the rules established by authorities.[53]

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[49] *See* ROBERTO MANGABEIRA UNGER, PLASTICITY INTO POWER: COMPARATIVE HISTORICAL STUDIES IN THE INSTITUTIONAL CONDITIONS OF ECONOMIC AND MILITARY SUCCESS: VARIATIONS ON THEMES OF POLITICS, A WORK IN CONSTRUCTIVE SOCIAL THEORY 153 (1987) (defining plasticity as "the facility with which work relations among people—in a plant, in a bureau, in an army—can be constantly shifted in order to suit changing circumstances, resources, and intentions").

[50] Travis D. Breaux & Ashwini Rao, *Formal Analysis of Privacy Requirements Specifications for Multi-tier Applications*, INST. FOR SOFTWARE RES., CARNEGIE MELLON UNIV. (2013), http://www.cs.cmu.edu/~./breaux/publications/tdbreaux-re13.pdf. By analogy, similarly granular, calibrated, and diverse preferences should be attainable in trading contexts.

[51] Surden, *supra* note 20, at 645.

[52] BERNARD HARCOURT, THE ILLUSION OF FREE MARKETS 13 (2011) (describing complex rules of commodity trading as an illustrative example of the book's larger themes on the rule-boundedness of contemporary economies).

[53] Pistor, *supra* note 10, at 317. Several other articles in the same journal issue discuss the implications of LTF for derivatives, foreign currency exchange, and central banking. Though some partisans of cryptocurrencies claim that they can enable extralegal transactions of securities (among other products and services), the frequent scandals and crises dogging Bitcoin suggest that caution is warranted. David Golumbia, *Bitcoin as Politics: Distributed Right-Wing Extremism*, *in* THE MONEYLAB READER 127 (Geert Lovink et al. eds., 2015), *available at* http://networkcultures.org/wp-content/uploads/2015/04/MoneyLab_reader.pdf ("[T]he problems with currencies actually aren't formal, or mechanical, or algorithmic, despite what Bitcoin

HFT strategies became widespread after the SEC engaged in a rulemaking—pursuant to Regulation National Market System (NMS)—designed to connect disparate stock exchanges and to encourage competition among them.[54] The idea behind Regulation NMS was noble: to ensure a level trading field by requiring regulated exchanges to share information on the best prices on offer for any given shares.[55] However, the new regulatory obligations quickly set off a frenzied effort among traders to be at the "front of the line" of those receiving news of trades, and acting on it. Exchanges quickly figured out that there was money to be made by providing differential or slightly sequenced access to information. "Dark pools" arose, allegedly to help clients escape predation by high-frequency traders. However, such pools can have their own problems, as recently exposed in the New York Attorney General's lawsuit against Barclays for dark pool practices.[56]

Algorithmic trading's primary appeal is that it allows transactions to occur in fractions of a second. For better or worse, modern market makers appear to value this more highly than thinking more creatively about other approaches to the problem of ties. HFT's proponents argue that this technology increases market efficiency, promotes liquidity, and reduces price volatility.[57] Here, efficiency mainly means reducing the cost and time required to trade stocks. Before HFT, a trader might have to wait for minutes or hours for a buyer or seller to take his order. As HFT firms expand, they are constantly buying and selling, taking the other side of orders, and thus reducing brokers' wait.[58] Efficiency is closely related to *liquidity*, which is "the ability to sell any asset for other assets or cash at will."[59] According to HFT's defenders, by increasing liquidity and efficiency, faster trading also assures more stable pricing.[60] For example, if someone has to wait hours for a trade to occur, he may become desperate and underprice what he is trying to sell. A constant

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propagandists desperately want us to believe. They are social and political problems that can only be solved by political mechanisms. That is why, despite the rhetoric of Bitcoin advocates, right now most sovereign currencies are far more stable than Bitcoin will ever or can ever be . . . .").

[54] Regulation National Market System, 17 C.F.R. § 242.601 (2013).

[55] Laura Nyantung Beny, *U.S. Secondary Stock Markets: A Survey of Current Regulatory and Structural Issues and a Reform Proposal to Enhance Competition*, 2002 COLUM. BUS. L. REV. 399, 426 (discussing the notice of proposed rulemaking, and observing that "the express purpose of the NMS [is] to promote efficiency and competition across secondary markets"); Richard Finger, *High Frequency Trading: Is It a Dark Force Against Ordinary Human Traders and Investors?*, FORBES (Sept. 30, 2013, 8:41 AM), http://www.forbes.com/sites/richardfinger/2013/09/30/high-frequency-trading-is-it-a-dark-force-against-ordinary-human-traders-and-investors.

[56] Discussed *infra* Part III.

[57] Brown, *supra* note 30, at 210; Brunzell, *supra* note 20, at 12 (discussing the common arguments proponents of HFT make supporting its use).

[58] *See generally* RISHI K. NARANG, INSIDE THE BLACK BOX: THE SIMPLE TRUTH ABOUT QUANTITATIVE TRADING (2009).

[59] Pistor, *supra* note 10, at 316.

[60] For an account of the benefits of HFT, see Lin, *supra* note 8, at 692–93, 725.

flow of orders is supposed to stop such distortions. The next two sections explore these claims in more detail.

1.   Efficiency and Liquidity

Among finance theorists, the case for HFT is straightforward. Automation in general improves efficiency by replacing relatively expensive and slow humans with relatively cheap and fast machines.[61] In stock trading, the spread of software-based systems has greatly increased trading volume. Thus, "parties are able to make markets in a broader spectrum of securities electronically rather than manually, cutting costs of hiring additional traders."[62] Since "high-frequency traders will also program buying/selling rules directly into the trading algorithm," users often assume that no human error will interfere with the execution of their strategies.[63] Moreover, the vast scale of HFT operations is supposed to improve liquidity—that is, the ease of execution of any given order.[64] The more that traders are out trying to execute large-scale purchases and sales, the better chance ordinary individuals have to find someone on the other side of their trades.[65]

In discussing efficiency and liquidity, it is important not to equate the mere existence of technological advance with the improvement of processes affected by it.[66] HFT has accelerated a *reductio ad absurdum* of financial self-reference, where value derives entirely from the

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[61] *See* NICHOLAS CARR, THE GLASS CAGE: AUTOMATION AND US 5 (2014); CHRISTOPHER STEINER, AUTOMATE THIS: HOW ALGORITHMS CAME TO RULE OUR WORLD 10 (2012); Danielle Keats Citron & Frank Pasquale, *The Scored Society: Due Process for Automated Predictions*, 89 WASH. L. REV. 1, 3 (2014); Frank Pasquale & Glyn Cashwell, *Four Futures of Legal Automation*, 63.1 UCLA L. REV. DISC. (forthcoming 2015) (discussing the role of automation in law); Frank Pasquale, *To Replace Or Respect: Futurology as if People Mattered*, BOUNDARY2 (Jan. 20, 2015), http://boundary2.org/2015/01/20/to-replace-or-respect-futurology-as-if-people-mattered (describing substitution of robots and software for human expertise).

[62] ROBERT KISSELL, THE SCIENCE OF ALGORITHMIC TRADING AND PORTFOLIO MANAGEMENT 1 (2014).

[63] *Id.* at 2; *see also* Matthew Philips, *What Michael Lewis Gets Wrong About High-Frequency Trading*, BLOOMBERG BUS. WK. (Apr. 1, 2014), http://www.bloomberg.com/bw/articles/2014-04-01/what-michael-lewis-gets-wrong-about-high-frequency-trading; Tim Worstall, *Michael Lewis is Entirely Wrong About High Frequency Trading Hitting the Little Guy*, FORBES BLOG (Mar. 31, 2014, 10:23 AM), http://www.forbes.com/sites/timworstall/2014/03/31/michael-lewis-is-entirely-wrong-about-high-frequency-trading-hitting-the-little-guy. *But see* Andrew Leonard, *Michael Lewis Hits Back: "There's Been a lot of People Mouthing Off Without Actually Thinking About the Book,"* SALON BLOG (Apr. 11, 2014, 2:44 PM), http://www.salon.com/2014/04/11/michael_lewis_hits_back_at_critics_this_time_i_punched_wall_street_in_the_balls (Lewis responding to criticism of the book).

[64] *See* Clifford S. Asness & Michael Mendelson, *High Frequency Hyperbole*, WALL ST. J., Apr. 2, 2014, at A17.

[65] *Id.*

[66] Critical digital theorists like David Golumbia have long questioned the conflation of novelty and value in technology theory. Golumbia, *supra* note 37.

manipulation of (split-second) perceptions of value encoded on trading terminals.[67] Even if HFT promotes liquidity, the mere opportunity to buy and sell is not always and everywhere good in itself. As John Cassidy, author of *What Good Is Wall Street?*, has observed:

> The liquidity of Internet stocks persuaded investors to buy them in the belief they would be able to sell out in time. The liquidity of subprime-mortgage securities was at the heart of the credit crisis. Home lenders, thinking they would always be able to sell the loans they made to Wall Street firms for bundling together into mortgage bonds, extended credit to just about anybody. But liquidity is quick to disappear when you need it most. Everybody tries to sell at the same time, and the market seizes up.[68]

Thus finance expert Wallace Turbeville has proposed that finance theory needs to rethink the value of digitally generated liquidity.[69] The pursuit of speed of ordering for its own sake has now reached the point that it rewards the purchasing power of certain traders (their ability to buy access to mountain-spanning cables) over their skill at allocating capital.

While HFT's defenders defend the technology as a modernization of markets, it often amounts to little more than an arms race for speed that helps only those who happen to have, at any given time, the fastest connections, best access to information on order flows, or most manipulative algorithms. All three advantages can become very expensive. The firm Spread Networks estimated that its exclusive, proprietary cable between New York and Chicago would generate $20 billion in revenue per year.[70] As the next section will demonstrate, firms that pay for access to order flows must make up the money somewhere. Top computer science talent (to develop new algorithms) is not only expensive for firms themselves, but also draws the technically talented away from fields like transportation, energy, and pharmaceuticals, where their skills could contribute to real productivity gains.[71]

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[67] HFT often involves "very high order amounts; rapid order cancellation; a flat position at the end of the trading day; extracting very low margins per trade; and trading at ultra-fast speeds." Keller, *supra* note 43, at 1459.

[68] John Cassidy, *What Good is Wall Street?*, THE NEW YORKER, Nov. 29, 2010, *available at* http://www.newyorker.com/magazine/2010/11/29/what-good-is-wall-street; *cf.* JOHN CASSIDY, HOW MARKETS FAIL: THE LOGIC OF ECONOMIC CALAMITIES 145 (2009) (discussing paradoxes of liquidity in more detail).

[69] Turbeville, *supra* note 35, at 8.

[70] LEWIS, *supra* note 1, at 15.

[71] Frank Pasquale, *Diagnosing Finance's Failures: From Economic Idealism to Lawyerly Realism*, 6 INDIA L.J. 2 (2012), *available at* http://www.indialawjournal.com/volume6/issue-2/book-review.html (reviewing ROBERT J. SCHILLER, FINANCE AND THE GOOD SOCIETY (2012)); *see also* Paul Kedrosky & Dane Stangler, *Financialization and Its Entrepreneurial Consequences*, KAUFFMAN FOUND. RES. SERIES (Mar. 2011), http://www.kauffman.org/~/media/kauffman_org/research%20reports%20and%20covers/2011/03/financialization_report_32311.pdf.

Moreover, once some firms have entered the arms race, others must join. Traders worry about being "picked off" by a lurking algorithm. The more HFT activity occurs, the more other firms must invest in masking their own moves to avoid being "front run" (i.e., having news of their impending orders drive the market in ways that make their orders more expensive). HFT mavens effectively tax the rest of the market.[72]

Many exposés have recently questioned exactly what 401(k) "expense ratios" or other mysterious finance fees go toward.[73] As fund managers need to anticipate and deflect high-frequency traders' arbitrage strategies, at least part of the answer should be clear. Armoring against them takes expensive talent and software: to study past patterns of trading, to sequence trades so they do not set off algorithmic strategies, or simply to avoid trading in particularly fraught times. The think tank Dēmos estimates that, over a lifetime, retirement account fees "can cost a median-income two-earner family nearly $155,000."[74] Investor John Bogle notes that a two percent fee applied over a fifty-year investing lifetime would erode *sixty-three percent* of the value of an average account.[75]

Some argue that "self-regulation" can solve these problems, expecting consumers to demand lower fees on their investments.[76] But unilateral disarmament by any one player in trading merely opens up its clients to more advantage-taking by high-frequency traders, or the exchanges they use. The finance sector *as a whole* has little interest in stopping such wasteful activities. The more treacherous it becomes for outsiders to trade in the brave new world of computerized markets, the

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[72] Matthew O'Brien, *High-Speed Trading Isn't About Efficiency—It's About Cheating*, ATLANTIC (Feb. 8, 2014, 9:00 AM), http://www.theatlantic.com/business/archive/2014/02/high-speed-trading-isnt-about-efficiency-its-about-cheating/283677; Charles Schwab & Walt Bettinger, *Schwab Statement on High-Frequency Trading* (Apr. 3, 2014), http://www.aboutschwab.com/press/statements/schwab-statement-on-high-frequency-trading.

[73] *See, e.g.*, TERESA GHILARDUCCI, WHEN I'M SIXTY-FOUR: THE PLOT AGAINST PENSIONS AND THE PLAN TO SAVE THEM (2008).

[74] Robert Hiltonsmith, *The Retirement Savings Drain: Hidden & Excessive Costs of 401(k)s*, DĒMOS (May 29, 2012), http://www.demos.org/publication/retirement-savings-drain-hidden-excessive-costs-401ks.

[75] Martin Smith, *The Retirement Gamble*, PUB. BROADCASTING SERVICE (Apr. 23, 2013), http://www.pbs.org/wgbh/pages/frontline/retirement-gamble ("Assume you're invested in a fund that is earning a gross annual return of 7 percent. They charge you a[] 2 percent annual fee. Over 50 years . . . Bogle says you've lost almost two thirds of what you would have had. [As Bogle puts it], 'the tyranny of compounding costs' is overwhelm[ing].").

[76] *See, e.g.*, Jason Voss, *Self-Regulation in the Financial Markets*, CFA INST. (June 24, 2014), http://blogs.cfainstitute.org/marketintegrity/2014/06/24/self-regulation-in-the-financial-markets. *But see* Mark A. Calabria, *Financial Regulation: Market or Government*, CATO INST., (Feb. 13, 2013), http://www.cato.org/publications/speeches/financial-regulation-market-or-government ("I will not be making the case for self-regulation. That's a straw-man, at best. No individual, whether a bank CEO, regulator or the President is capable of serving as a judge of their own actions. Unconstrained power generally ends badly.").

more they have to pay some knowledgeable insider a fee to fend off parasitic trading strategies.

2.   Price Stability

Assuming the stable continuation of trading over time at relatively similar price levels, HFT can indeed smooth price fluctuations. The more entities offering their honest opinion about the value of stocks (and their willingness to put their money behind those opinions), the smoother the price fluctuations.[77] But the nature of rapid fire trading can vitiate (or even reverse) both the honesty of a bid, and the bidder's obligation to actually follow through. When algorithms combine to generate herding and feedback loops, HFT participants become liquidity *takers*, not makers.[78] They create volatility at times when marketplaces are particularly vulnerable to disruption.

For example, consider "quote stuffing," a classic HFT strategy whereby a trader will flood the market with a large number of order quotes and then immediately—literally within fractions of a second—cancel the orders.[79] This causes congestion on an exchange and allows the stuffer to conceal its own trading strategy while less sophisticated traders are trying to process this flood of new information.[80] If those responding to the stuffer are likely to follow a certain pattern, and the stuffer successfully anticipates the pattern, he may be able to trade off that anticipated response.[81]

Similarly, "spoofing" (sometimes called "layering") involves a trader making a large number of buy orders with the intent to cancel.[82] The purpose of placing the orders is to create an impression of buy-side interest and drive the prices up.[83] Once prices have been driven up, the trader cancels its original purchase bids and sells to other traders who

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[77] Tom W. Bell, *Government Prediction Markets: Why, Who, and How*, 116 PENN. ST. L. REV. 403 (2011); Miriam A. Cherry & Robert L. Rogers, *Prediction Markets and the First Amendment*, 2008 U. ILL. L. REV. 833; Cass R. Sunstein, *Deliberating Groups Versus Prediction Markets (Or Hayek's Challenge to Habermas)* (Univ. of Chi. Law & Econ., Olin Working Paper No. 321; Univ. of Chi., Pub. Law & Legal Theory, Working Paper No. 146, 2007), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=956189.

[78] Turbeville, *supra* note 35.

[79] Keller, *supra* note 43, at 1468.

[80] *Id.*

[81] *Id.* at 1468–69.

[82] Prewitt, *supra* note 40, at 148 (discussing "spoofing" and other deceptive HFT tactics).

[83] Andrew Saks McLeod, *CFTC Fines Algorithmic Trader $2.8 Million for Spoofing in the First Market Abuse Case Brought by Dodd-Frank Act, and Imposes Ban*, FOREX MAGNATES (July 22, 2013), http://forexmagnates.com/cftc-fines-algorithmic-trader-2-8-million-for-spoofing-in-the-first-market-abuse-case-brought-by-dodd-frank-act.

have been duped into buying at a higher price.[84] Again, this all occurs within fractions of a second. These patterns of trading recall "pump and dump" schemes, and only a small number have been prosecuted.[85] But as they grow ever subtler and more complex, it is hard for even committed financial law enforcers to monitor them—particularly as the rest of the financial sector suffers a crime wave, effectively diverting attention and resources from patterns of behavior that are not obviously fraudulent.[86]

Algorithmic trading can create extraordinary instability and frozen markets when split-second trading strategies interact in unexpected ways.[87] Consider, for instance, the flash crash of May 6, 2010, when the stock market lost hundreds of points in a matter of minutes.[88] In a report on the crash, the CFTC and SEC observed that "as liquidity completely evaporated," trades were "executed at irrational prices as low as one penny or as high as $100,000."[89] Traders had programmed split-second algorithmic strategies to gain a competitive edge, but soon found themselves in the position of a sorcerer's apprentice, unable to control the technology they had developed.[90] Though prices returned to normal the same day, there is no guarantee future markets will be so lucky.

Andrew G. Haldane, the Executive Director of Financial Stability at the Bank of England, posits a trade-off between "efficiency and stability"

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[84] *See* Prewitt, *supra* note 40; Robert C. Fallon, *High-Frequency Trader "Spoofs" and "Layers" His Way to Penalties from U.S. and British Regulators*, LEXOLOGY (July 30, 2013), http://www.lexology.com/library/detail.aspx?g=c6f66fb4-e220-47be-896a-7352984c9622.

[85] *See* Matthew Weinschenk, *Wall Street's White-Collar 'Pickpockets' are Scalping Your Profits*, WALL ST. DAILY (Apr. 4, 2011), http://www.wallstreetdaily.com/2011/04/04/high-frequency-trading-computers.

[86] Gregory M. Gilchrist, *The Special Problem of Banks and Crime*, 85 U. COLO. L. REV. 1 (2014); Cora Currier & Lena Groeger, *A Scorecard for This Summer's Bank Scandals*, PROPUBLICA (Aug. 21, 2012, 10:12 AM), http://www.propublica.org/special/a-scorecard-for-this-summers-bank-scandals.

[87] ARNUK & SALUZZI, *supra* note 1; Turbeville, *supra* note 35.

[88] *See* U.S. SEC. EXCH. COMM'N, FINDINGS REGARDING THE MARKET EVENTS OF MAY 6, 2010: REPORT OF THE STAFFS OF THE CFTC AND SEC TO THE JOINT ADVISORY COMMITTEE ON EMERGING REGULATORY ISSUES (2010), *available at* http://www.sec.gov/news/studies/2010/marketevents-report.pdf.

[89] *Id.* at 5.

[90] *See id.* at 79 ("It has been hypothesized that these delays are due to a manipulative practice called 'quote-stuffing,' in which high volumes of quotes are purposely sent to exchanges in order to create data delays that would afford the firm sending these quotes a trading advantage."). Note also the disastrous $440 million loss of Knight Capital in August 2012, which was traced to IT/software issues at the firm that took nearly an hour to fix—losing the firm $440 million in the meantime. Dan Olds, *How One Bad Algorithm Cost Traders $440m*, REGISTER (Aug. 3, 2012), http://www.theregister.co.uk/2012/08/03/bad_algorithm_lost_440_million_dollars; Stephanie Ruhle, Christine Harper & Nina Mehta, *Knight Trading Loss Said to Be Linked to Dormant Software*, BLOOMBERG (Aug. 14, 2012, 6:23 PM), http://www.bloomberg.com/news/2012-08-14/knight-software.html. Korean exchanges faced a smaller crash in late 2013.

in financial markets.[91] It is perhaps plausible that, on some crabbed definition of "efficiency," ever more orders (of whatever quality, reliability, or duration) increase the efficiency of equity markets. But when technologies of HFT can both a) lure ever more individuals into assuming there will always be another side to their potential trades, and b) suddenly depart the market as soon as any trouble arises, they necessarily increase the possibility of instability.

In short, HFT's benefits are debatable. A trading practice cannot be credited with "increasing stability" or "enhancing liquidity" simply because it makes business faster or easier on ordinary days. *All* the effects of the practice must be taken into account.[92] Otherwise, HFT will take advantage of the same selective accounting that led to the rise of toxic collateralized debt obligations and credit default swaps.[93]

Fortunately, those with a longer-term perspective on market developments are beginning to underscore familiar risks with new financial technology. As Charles Korsmo has documented, risks associated with HFT include "market manipulation," "'parasitic' trading," "negligently designed rogue algorithms," "reducing allocative efficiency by driving prices away from fundamental values," and "overburdening of market infrastructure."[94] There is an established set of laws and regulations designed to deal with at least some of these risks, including market manipulation and negligent trading practices. Those legal tools are the foundation of the present, minimalist agenda of federal agencies and state officials in various actions against high-frequency traders, discussed in Part III below.

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[91] Andrew G. Haldane, The Race to Zero: Speech at the International Economic Association Sixteenth World Congress in Beijing, China 14 (July 8, 2011), http://www.bis.org/review/r110720a.pdf ("Minimum resting periods . . . tackle the arms race at source by imposing a speed limit on trading. . . . By increasing the per period transaction cost, the imposition of a minimum resting period would tend to widen bid-ask spreads and damage market liquidity in peacetime. . . . That is of course only one side of the coin. Setting a minimum T would also tend to reduce the risk of liquidity drought. While raising the average bid-ask spread, it might also lower its variability at times of stress. Liquidity would on average be more expensive but also more resilient. So in determining whether there is a role for minimum resting periods, this trade-off between market efficiency and stability is key.").

[92] John C. Coates, *Cost-Benefit Analysis of Financial Regulation: Case Studies and Implications*, YALE L.J. (forthcoming 2015) (discussing the underestimation of the benefits, and overestimation of costs, of financial regulation in many studies), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2434103.

[93] For a description of the misleading modeling that led to the success of those instruments, see FIN. CRISIS INQUIRY COMM'N, THE FINANCIAL CRISIS INQUIRY REPORT, at xxv (Jan. 2011), [hereinafter FCIC REPORT], *available at* http://fcic-static.law.stanford.edu/cdn_media/fcic-reports/fcic_final_report_full.pdf; U.S. SENATE SUBCOMM. ON INVESTIGATIONS, COMM. ON HOMELAND SEC. & GOVERNMENTAL AFFAIRS, WALL STREET AND THE FINANCIAL CRISIS: ANATOMY OF A FINANCIAL COLLAPSE 6 (Apr. 2011), *available at* http://hsgac.senate.gov/public/_files/Financial_Crisis/FinancialCrisisReport.pdf.

[94] Korsmo, *supra* note 8, at 551.

II. THE MINIMALIST AGENDA OF REGULATORS

While the benefits of HFT have seemed ever more illusory over the past few years, its costs have become clearer. Traders not privy to HFT methods have complained that prices suddenly rise when they try to order equities, or suddenly fall when they try to sell.[95] Investors have grown suspicious that the exchanges they trade on are sending news of their trades to firms operating predatory algorithms.[96] A joint report by the CFTC and SEC suggested that quote stuffing had contributed to the Flash Crash of 2010.[97] Other market disruptions, such as the delayed Facebook IPO, have been blamed on rapid order and cancellation practices.[98] Charges and countercharges fly, as those running brokerages, exchanges, and agencies struggle to demarcate an ever-shifting line between legitimate practices, troubling (but still legal) advantage-taking, and clearly illegal actions.

So far, federal regulators and state officials have squarely focused on the last category: clearly illegal activities. To understand the legal landscape they are creating, it is helpful to present some of the leading regulatory initiatives and lawsuits against HFT firms and the exchanges they use. HFT firms are accused of obtaining access to information about pending orders before the rest of the market obtains it. Securities law has long prohibited "insider trading" (i.e., trading on the basis of material, nonpublic information) and "front-running."[99] In principle, the privileged access to information of high-frequency traders should clearly be problematic.[100] But a number of loopholes and exceptions to

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[95] LEWIS, *supra* note 1, at 33–34.

[96] *See* Steve Kroft, *Is the U.S. Stock Market Rigged?*, CNN.com (Mar. 30, 2014), http://www.cbsnews.com/news/is-the-us-stock-market-rigged (noting the frustration an investor had about not knowing how he was being front-run).

[97] REPORT OF THE STAFFS OF THE CFTC AND SEC TO THE JOINT ADVISORY COMMITTEE ON EMERGING REGULATORY ISSUES, *supra* note 88, at 79 ("It has been hypothesized that these delays are due to a manipulative practice called 'quote-stuffing' in which high volumes of quotes are purposely sent to exchanges in order to create data delays that would afford the firm sending these quotes a trading advantage.").

[98] Telis Demos, *'Raindrops' Raise Questions After Facebook IPO*, FIN. TIMES (May 21, 2012, 1:29 AM), http://www.ft.com/intl/cms/s/0/c1e84ac6-a2c8-11e1-826a-00144feabdc0.html#axzz 3917A0iai.

[99] Front-running occurs when a person, often a stock-broker, trades in advance of their client in an attempt to take advantage of the expected change in the price of a security that will occur due to that client's upcoming trade. The SEC has found such a tactic to violate the same statute, 15 U.S.C. § 78j(b) (2012), as insider trading. ALDRIDGE, *supra* note 2, at 221.

[100] Section 10(b) of the Securities and Exchange Act of 1934 makes it illegal for any person

> [t]o use or employ, in connection with the purchase or sale of any security registered on a national securities exchange or any security not so registered, or any securities-based swap agreement any manipulative or deceptive device or contrivance in contravention of such rules and regulations as the [SEC] may prescribe.

15 U.S.C. § 78j(b) (2012). Rule 10b-5 states that

insider trading law have arisen over the past several decades. The timing of access to information is a fraught topic. Nevertheless, certain basic fiduciary, statutory, administrative, and common-law obligations endure.

These cases can be broken down into two broad categories. First, as Section A shows, taking unfair advantage of early information can result in legal trouble. Section B below describes other problematic strategies, focusing on high-frequency traders affirmatively creating misinformation in order to deceive other traders.

A.   *Punishing the Unfair Use of Early Information*

One of the oldest violations of trust in stock trading is front running. A brokerage privy to a client's order may front run the client by executing its own trades based on anticipation of what the client's trades will do the market.[101] Critics of HFT long worried that firms which promised to protect clients from some obvious HFT tactics also exposed them to other, more surreptitious ones. In 2014, New York Attorney General Eric Schneiderman further stoked their fears by filing a suit alleging "fraud and deceit by one of the world's biggest banks," Barclays.[102]

Ironies abound in the case. Barclays marketed to clients the opportunity to trade in a proprietary "dark pool"—an exchange that matches buy and sell orders, but does not immediately display to the market generally the submission of pending stock orders.[103] Supposedly, trading in that pool would keep the news of their impending trades from reaching high-frequency traders—whom Barclays itself called "toxic"

> [i]t shall be unlawful for any person, directly or indirectly, by the use of any means or instrumentality of interstate commerce, or of the mails or of any facility of any national securities exchange, (a) [t]o employ any device, scheme, or artifice to defraud, (b) [t]o make any untrue statement of a material fact or to omit to state a material fact necessary in order to make the statements made, in the light of the circumstances under which they were made, not misleading, or (c) [t]o engage in any act, practice, or course of business which operates or would operate as a fraud or deceit upon any person, in connection with the purchase or sale of any security.

17 C.F.R. § 240.10b-5 (2014).

[101] Similar to the above-mentioned order discovery strategies, front running occurs when an HFT trader has notice of a large trade that is about to be executed. The trader will then "run in front" and buy the stock, thereby pushing up the price that the purchaser of the large trade pays. ALDRIDGE, *supra* note 2, at 219–20 ("[U]nscrupulous brokers possessing order-flow data may choose to front-run their own clients whenever they detect a large impending price move.").

[102] Complaint at 1, People v. Barclays Capital, Inc., No. 0451391/2014 (N.Y. Sup. Ct. June 25, 2014), *available at* http://www.ag.ny.gov/pdfs/Barclays_complaint_as_filed_June_25_2014.pdf [hereinafter Barclays Complaint].

[103] *Id.* ¶ 10.

and "predatory."[104] An industry publication called Barclays' dark pool the "Best Dark Pool" in February 2014, and its market share had exceeded that of many other established dark pools by the beginning of 2014.

According to Schneiderman's complaint, the bank attained this market success by flatly misrepresenting what was going on in its dark pool.[105] For example, the complaint alleges, when Barclays depicted the "liquidity landscape" of its dark pool, it failed to depict the largest participant in the pool: Tradebot, which was a high-frequency trader.[106] According to the complaint, one employee called the omission a falsification of the data,[107] and a Barclays Vice President offered the following assessment: "I had always liked the idea that we were being transparent, but happy to take liberties if we can all agree."[108] The complaint alleges that Barclays' Head of Equity Sales then piped up "U smart" in response to the Head of Product Development's position that "the accuracy [of the chart] is secondary."[109] According to Schneiderman, Barclays used its privileged access to trading patterns to market the dark pool to large clients as a safe haven from predatory high-frequency trading, while also allowing up to fifty percent of the trades in the dark pool to be "aggressive."[110] Given Barclays' very recent scrapes with the law, the allegations were yet another reputational hit for the bank.[111]

It is not only exchanges that have come under fire for misusing marketplaces to take advantage of early information. Order discovery strategies allow an HFT trader to "ping" the market with multiple orders designed to detect the presence of a market participant with a large position that it is in the process of accumulating or liquidating.[112] The trader then purchases the stock, hoping to profit from the price increase/decrease.[113] Once they reach a critical mass, such pings can clog communication channels and create other problems for bona fide

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[104] *Id.* ¶ 1.

[105] All assertions about the case are drawn from the complaint; readers should note that, at the time of publication of this Article, the matter is still in litigation.

[106] *Id.* ¶ 40.

[107] *Id.* ¶ 41.

[108] *Id.* ¶ 43 (internal citations omitted).

[109] *Id.* ¶¶ 44–45.

[110] *Id.* ¶¶ 50, 52. *See also* Matt Levine, *Barclays Isn't out of Dark Pool Trouble Yet*, BLOOMBERG, Feb. 17, 2015, at http://www.bloombergview.com/articles/2015-02-17/barclays-isn-t-out-of-its-dark-pool-trouble-yet (offering update on the case, and Barclays' position on it).

[111] James B. Stewart, *Barclays Suit Sheds Light on Trading in Shadows*, N.Y. TIMES, July 5, 2014, at B1; *see also* Frank Pasquale, THE BLACK BOX SOCIETY: THE SECRET ALGORITHMS THAT CONTROL MONEY AND INFORMATION 122 (2015) ("Britain's Financial Conduct Authority revealed that on the day after Barclays was fined $450 million for attempted Libor rigging, its lax internal controls allowed manipulation of gold prices.").

[112] Turbeville, *supra* note 35, at 11.

[113] *Id.* at 11.

investors. Nevertheless, U.S. regulators have yet to control them. This lack of action reflects their overall minimalist agenda with respect to HFT. Regulators are cautious; they believe their central role is to strike a balance between allowing technology to flourish and making sure it is not undermining trading.

Caution has also slowed efforts to deter unfair advantages in information flow. For example, some traders have privileged access to news feeds before competitors, but regulators seem unconcerned.[114] While markets seem to have adjusted themselves to this inequality, in classic "caveat emptor" style, it is easy to imagine disruptive variations—for example, what if major outlets start to delay feeds to those who fail to pay some form of protection money? But there is not even a concept release on the topic, given agencies' narrow goal of combating only the worst abuses—not the broader trends toward zero-sum games of information advantage that give rise to them.

B. *Responding to Misrepresentation of Market Conditions*

High-frequency traders on Wall Street have taken the competition for an information advantage to absurd lengths, angling to close deals milliseconds before rivals do. Sometimes this strategy merely depends on acquiring information that is available to the high-frequency traders before it is more widely known. But high-frequency traders can also try to create the conditions they take advantage of, by misleading other market participants. Advances in technology have opened the door to new variations on old patterns of abuse.

For example, given the enormous volumes at stake in HFT and other algorithmic strategies, new variations on the classic "pump and dump" strategy—and its opposite, the "bear raid"—are emerging.[115] Generically called "order-triggering," they distort the market by creating

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[114] Scott Patterson, *Speed Traders Get an Edge*, WALL ST. J. (Feb. 6, 2014, 8:49 PM), http://www.wsj.com/articles/SB10001424052702304450904579367050946606562. Public companies issuing material information about their business will often use news-release distributors to help comply with Regulation FD, which requires they release the information at the same time to everyone. However, these distributors are not directly overseen by the SEC and are able to sell direct access to the information to HFT firms, enabling the firms to receive the information slightly before the rest of the market. *Id.*

[115] In a "bear raid," the trader enters a short sale that is large enough to push the price of the stock down. When other investors see the drop in price they assume that somebody knows something and decide to sell as well. This could also trigger stop orders. The trader will then buy the stock back at a lower price (to cover his short sale) and make a profit. ALDRIDGE, *supra* note 2, at 202 ("The flip side of the pump-and-dump is the *bear raid*, whereby the trader artificially depresses the price of a financial instrument, only to close his position at a profit at the first available opportunity, all while leaving other investors in the dust." (emphasis added)).

a misimpression of sudden, massive interest in a stock.[116] Another suspect strategy is spoofing, a "practice in which traders place and then cancel orders to give an artificial impression of an intention to buy or sell shares in order to move the market."[117] Also called "layering," spoofing was specifically proscribed by statute in the 2010 Dodd-Frank Wall Street Reform and Consumer Protection Act.[118] Other trading practices involving rapid order and cancellation—and executed with the intent of deceiving other traders and making a profit—include "strobing,"[119] "smoking,"[120] and "last second withdrawal."[121]

In July of 2013, the CFTC accused a spoofer of executing a high-speed, deceptive strategy that earned $1.4 million in less than two months.[122] The CFTC claimed that the firm's spoofing strategy began by offering to sell a small number of futures—with the full intent of selling them.[123] It quickly followed this with several large "buy" orders at high prices—with the intent of canceling them once they drove up the prices. By placing the "buy" orders, the CFTC claimed, they created an impression of buy-side interest, thus driving up prices. They then, according to the CFTC, canceled the "buy" orders and made a large profit on their sale since other traders started buying the futures at a higher price.[124] The spoofer settled the case and paid $1.4 million in

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[116] *See* James J. Angel & Douglas McCabe, *Fairness in Financial Markets: The Case of High Frequency Trading*, 112 J. Bus. Ethics 585, 589–90 (2013).

[117] Alex Lincoln-Antoniou & Mauro Wolfe, *HFT Spoof That Wasn't Funny*, Compliance Monitor (Sept. 2013), http://www.duanemorris.com/articles/static/wolfe_compliancemonitor_0913.pdf.

[118] Prewitt, *supra* note 40, at 148, 156 (discussing spoofing and other deceptive HFT tactics). "Spoofing" is illegal under Section 4c(a)(5)(C) of the Commodity Exchange Act, ch. 369, 42 Stat. 998 (1922) (codified at 7 U.S.C. § 6c(a)(5)(C) (2012)).

[119] "Strobing" is a HFT strategy in which the same order is sent and canceled many times to create the appearance of liquidity. The CFTC considers this a form of "spoofing." 17 C.F.R. § 180.1 (2014), promulgated pursuant to Dodd-Frank, also outlaws the use of "any manipulative device, scheme, or artifice to defraud."

[120] "Smoking" is an HFT scheme that exploits slow traders by offering attractive limit orders, then quickly revising these prices to take advantage of an unsuspecting slow trader's market order. Prewitt, *supra* note 40, at 148.

[121] "Last second withdrawal" refers to the strategy of canceling orders at the final second of a call procedure. *See* Brunzell, *supra* note 20.

[122] *See* McLeod, *supra* note 83 (discussing "spoofing"); *see also* Client Memorandum from Fried Frank, CFTC Update: Commodity Futures Trading Commission Assesses Penalty in First "Spoofing" Case (Aug. 6, 2013), *available at* http://www.friedfrank.com/siteFiles/Publications/FINAL%20-%208-6-2013%20-%20TOC%20Memo-%20CFTC%20Enforcement%20-%20Spoofing%20Case.pdf; Press Release, U.S. Commodity Futures Trading Comm'n, CFTC Orders Panther Energy Trading LLC and its Principal Michael J. Coscia to Pay $2.8 Million and Bans Them from Trading for One Year, for Spoofing in Numerous Commodity Futures Contracts (July 22, 2013), *available at* http://www.cftc.gov/PressRoom/PressReleases/pr6649-13.

[123] *See* Fried Frank Client Memorandum, *supra* note 122.

[124] This strategy has also been referred to as "layering." The British Financial Conduct Authority, also involved in the case, observed that the larger orders were canceled, which induced the market to trade the small orders.

disgorgement.[125] The CFTC's enforcement director, David Meister, said "using a computer program that is written to spoof the market is illegal and will not be tolerated."[126]

To better understand how the tactic worked, consider a simplified model of it. Let's say a stock had a best bid of $10.05 and a best offer of $10.50. The trader would place a buy order at $10.40 (which thereby became the best bid). The trader would then place a sell order at $10.40. Due to their previous "bid" of $10.40, a market-making firm would execute the trader's sell order at $10.40. Once the trade was executed, the trader then cancelled the original "bid" of $10.40. By doing so, the trader was able to sell shares at $10.40 instead of the original best bid of $10.05. This is, in essence, the same "spoofing" strategy that many HFT firms have employed in recent years, albeit at far faster speeds. They will place a bona fide order to buy (or sell) a stock and then place numerous other orders to buy (or sell) the same stock, with no intention of actually executing the trade. They place these non-bona fide orders in an attempt to manipulate other traders to execute against their original, bona fide, order. Once this occurs the trader will quickly cancel the non-bona fide order.

Not only the CFTC has expressed concern about these practices. The SEC signaled hostility to spoofers in 2001. It charged six spoofers with violating Section 17(a) of the Securities Act of 1933[127] and Section 10(b) of the Securities Exchange Act of 1934[128] (and rule 10b-5 promulgated thereunder).[129] In *SEC v. Shpilsky*, a trader placed bids that were never intended to be filled.[130] The intent was to manipulate the

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[125] Press Release, Commodity Futures Trading Comm'n, *supra* note 122.

[126] UK regulators (the British Financial Conduct Agency, or FCA) also fined Coscia and his firm (£597,993) for their spoofing strategy, and even the owners of the exchanges on which Coscia and his firm traded (like CME group, the owner of four exchanges Coscia traded on) also took some action; the exchanges fined Coscia (approximately $900,000) and imposed a six-month trading ban against him. Press Release, Commodity Futures Trading Comm'n, *supra* note 122; Fallon, *supra* note 84.

[127] 15 U.S.C. § 77q (2012) ("It shall be unlawful for any person in the offer or sale of any securities . . . by the use of any means or instruments of transportation or communication in interstate commerce or by the use of the mails . . . to engage in any transaction, practice, or course of business which operates or would operate as a fraud or deceit upon the purchaser.").

[128] *Id.* § 78j ("It shall be unlawful for any person . . . by the use of any . . . facility of any national securities exchange . . . [t]o use or employ, in connection with the purchase or sale of any security registered on a national securities exchange or any security not so registered . . . any manipulative or deceptive device or contrivance in contravention of such rules and regulations as the Commission may prescribe as necessary or appropriate in the public interest or for the protection of investors.").

[129] *See* 17 C.F.R. § 240.10b-5 (2014) ("It shall be unlawful for an person . . . by the use of any . . . facility of any national securities exchange . . . [t]o employ an device, scheme, or artifice to defraud . . . [t]o engage in any act, practice, or course of business which operates or would operate as a fraud or deceit upon any person, in connection with the purchase or sale of any security.").

[130] SEC v. Leonid Shpilsky et al., Exchange Act Release No. 17221, 2001 WL 1408740, at *2 (D.D.C. Nov. 5, 2001).

price for the shares involved, in order to make a quick profit.[131] A disgorgement remedy followed.[132] Another anti-spoofing case came in 2012, when the SEC filed an action against Hold Brothers, an HFT firm.[133] The Respondents, without admitting or denying guilt, settled for around $7 million. The SEC brought similar charges in 2014 against another HFT firm.[134] Again, without admitting or denying the findings, Visionary settled for $3 million.[135]

Agency commissioners have explained the policy rationale for such actions. SEC Commissioner Elisse Walter has called rapid order cancellation a form of market abuse.[136] Both the CFTC and the SEC have issued a joint report that contained recommendations for cracking down on rapid order and cancellation.[137] Regulators appear to be converging on one principle: certain ways of creating market conditions are illicit and must be stopped.

In September of 2013, the CFTC issued the Concept Release on Risk Controls and System Safeguards for Automated Trading Environments (Concept Release).[138] It included proposals addressing the unfair use of early information and the misrepresentation of market conditions. But, while the CFTC acknowledged that certain HFT traders were getting early access to some non-government economic data for a

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[131] *Id.*

[132] *Id.* ("Without admitting or denying the Commission's allegations, Shpilsky consented to be permanently enjoined from violating the antifraud provisions of the federal securities laws (*i.e.*, Section 17(a) of the Securities Act of 1933 and Section 10(b) of the Securities Exchange Act of 1934 and Rule 10b-5 promulgated thereunder), and pay $12,000 in disgorgement.").

[133] In the Matter of Hold Brothers On-Line Investment Services, LLC, Release No. 67924 (Sept. 25, 2012). They were charged with failing to comply with Section 9(a)(2) of SEC Act of 1934 aka (15 U.S.C.A. § 78i (2012)). *Id.*

[134] In the Matter of Visionary Trading, LLC, Release No. 71871 (Apr. 4, 2014). The SEC also charged them with violating Section 10(b) of the Securities Exchange Act of 1934 (Rule 10b-5). *Id.*

[135] *Id.*

[136] Elisse Walter, Chairman, SEC, Speech at American University School of Law: Harnessing Tomorrow's Technology for Today's Investors and Markets (Feb. 19, 2013), *available at* http://www.wcl.american.edu/news/chairmanwalter_2013.cfm. Her prepared remarks are also available at http://www.sec.gov/News/Speech/Detail/Speech/1365171492300#.UlheExDt5G0 (arguing for technology to "help us monitor and understand mini-flash crashes, or pick up on possibly troublesome or illegal behavior, for example, by noting excessive cancellations of message traffic").

[137] Joint CFTC-SEC Advisory Comm. on Emerging Regulatory Issues, Recommendations Regarding Regulatory Responses to the Market Events of May 6, 2010 (2011), *available at* http://www.cftc.gov/ucm/groups/public/@aboutcftc/documents/file/jacreport_021811.pdf.

[138] Concept Release on Risk Controls and System Safeguards for Automated Trading Environments, 78 FR 56542-01 (proposed Sept. 12, 2013), *available at* http://www.cftc.gov/ucm/groups/public/@lrfederalregister/documents/file/2013-22185a.pdf. Then-Commissioner Bart Chilton noted that "those involved in the financial markets seem to have blindly accepted that technology is almost always a good thing," and pointed out the need to consider the legal bases of troubling trading practices. He criticized the CFTC's "puny penalty regime" (a civil monetary penalty of $140,000 per violation). *Id.*

fee, it failed to make any concrete suggestions about how to fix the unfair advantage.[139]

The CFTC did note in the Concept Release that in 2010, they had published a Proposed Rule stating that co-location had to be offered on an equal access basis, fees had to be uniform and non-discriminatory, and that information about the latency for various connectivity options had to be provided.[140] However, pending finalization of the Rule, there is still ample opportunity for troubling arbitrage via opportunistic co-location.

The CFTC also discussed execution throttles (which prevent algorithms from exceeding their expected message rate or rate of execution) as a way to prevent the manipulative strategy called "order stuffing."[141] The CFTC also discussed whether there should be a minimum time period that orders must remain on the order book before they can be withdrawn.[142] An overload of trading activity can strategically slow down some trading venues, thereby giving an advantage to those HFT traders who know which systems to use.[143] By implementing message rate limits, an HFT trader would be unable to (or at least greatly limited) in the ability to implement an "order stuffing" strategy since it relies on the ability to send an extraordinary amount of orders that are quickly canceled.[144]

There are currently a number of trading pause methodologies in effect at exchanges. Some of these include mandatory pauses when prices move in excess of a certain amount during the trading day, as well as when the execution of resting stop orders would cause excessive price movements.[145] The CFTC is considering whether there are any additional types of pause triggers that should be implemented, to

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[139] *Id.* at 74. However, the CFTC did request public comment concerning whether there are additional measures that might be taken to protect government economic reports from inappropriate early disclosure. *Id.* In addition, the CFTC asked the public whether certain types of these reports should be allowed to be disclosed early and asked the public to describe the extent to which HFT firms should be able to acquire early access to potentially market-moving non-governmental economic reports. *Id.*

[140] Concept Release, *supra* note 138, at 17.

[141] *Id.* Order stuffing is the "practice where a large number of orders to buy or sell securities are placed and then canceled almost immediately." Jared F. Egginton et al., *Quote Stuffing* (Mar. 22, 2014) (unpublished manuscript), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1958281.

[142] Concept Release, *supra* note 138, at 83.

[143] JOHN W. MCPARTLAND, FED. RESERVE BANK CHI., RECOMMENDATIONS FOR EQUITABLE ALLOCATION OF TRADES IN HIGH FREQUENCY TRADING ENVIRONMENTS 9 (2014), *available at* https://www.chicagofed.org/publications/policy-discussion-papers/2013/pdp-1.   One commentator likened the practice to driving a racecar at 190 miles per hour but preventing the other drivers from exceeding 160 miles per hour. *Id.*

[144] Concept Release, *supra* note 138, at 44.

[145] *Id.* at 51.

combat a "significant number of aggressive orders, or a significant number of cancelled orders."[146]

To "better enable market participants to manage their ATSs (Alternative Trading Systems) in ways that further promote market stability and integrity," the CFTC has also requested comments on the advisability of increased disclosure of market quality indicators.[147] A consistent calculation methodology across exchanges for several measures would "ensure compatibility and comparability across market venues."[148] But the CFTC also acknowledged that the metrics could be used by market participants to manipulate the order book, identify other trader's strategies, or engage in other trading activities that do not contribute to efficient price discovery.[149]

Financial markets are also subject to a form of "self-regulation"—the authority of the Financial Industry Regulatory Authority (FINRA).[150] Wary of provoking further government interventions, the FINRA, as an agent of the finance industry, has taken on the worst HFT practices. In 2012, for example, FINRA fined an investment company $2.3 million for "layering" markets with a high volume of false orders in 2006 and 2007.[151] And in May of 2012, inspired by shady practices contributing to the delayed Facebook IPO, Nasdaq, and DirectEdge announced the introduction of fees on high-frequency traders who send a large number of order cancellations into the exchanges.[152]

Despite these actions, many commentators remain disappointed in regulators' caution.[153] At the federal level, regulators are focused on activities that clearly fit preexisting ideas of market manipulation.

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[146] *Id.* at 52.

[147] *Id.* at 78–79. The list of measures include:

> (1) effective spreads; (2) order-to-fill ratios; (3) execution speeds by order type and order size; (4) average aggressiveness imbalances; (5) price impact for given trade sizes; (6) average order duration; (7) order efficiency; (8) rejection order ratios; (9) net position changes versus volume; (10) branching ratios; (11) volume imbalance and trade intensity; (12) Herfindahl-Hirschman Indexes based on market share of open positions under common control; and (13) metrics on the number of price changing trades involving ATSs.

Id. at 88 (footnotes omitted).

[148] *Id.* at 79.

[149] *Id.* at 81.

[150] Order Approving Proposed Rule Change to Amend the By-Laws of NASD to Implement Governance and Related Changes to Accommodate the Consolidation of the Member Firm Regulatory Functions of NASD and NYSE Regulation, Inc., Exchange Act Release No. 34-56145 (July 26, 2007), *available at* http://www.sec.gov/rules/sro/nasd/2007/34-56145.pdf.

[151] ALDRIDGE, *supra* note 2, at 200 ("[M]anipulative layering is one-sided: a market participant 'layers' either buy or sell side of the order book with limit orders and then promptly cancels the orders with the intent of changing other traders' inferences about available supply and demand.").

[152] Bob Pisani, *More Fallout From the Facebook Fiasco*, CNBC (May 25, 2012, 9:18 AM), http://www.cnbc.com/id/47564512.

[153] Sonia A. Steinway, *SEC "Monetary Penalties Speak Very Loudly," but What Do They Say? A Critical Analysis of the SEC's New Enforcement Approach*, 124 Yale L.J. 209 (2014).

FINRA's initiatives are even more wan. Though Eric Scheiderman's action in New York was bold, it was also handed to his office on a silver platter—a disgruntled former employee of Barclays provided many of the key emails, as a whistleblower. None of the current leading players in HFT regulation seem to have a clear vision regarding either the purpose of financial markets, or their own role in contributing to its realization. Part IV explores such a vision, and the types of regulatory approaches it would yield.

III.   DECELERATING FINANCE

The legal battles over HFT are likely to persist for years. Each time an agency or court renders a certain HFT practice illegal (or merely suspect), quants are wont to tweak it to maintain the practice's substance while evading the legal characterization that made it punishable in the first place. Such regulatory arbitrage is a cornerstone of contemporary finance lawyering.[154] Small changes to algorithms may be genuinely responsive to the concerns of regulators, or may simply change the form of the trading while doing little to address the original substantive concerns about a level playing field.

For most legal academics, regulators, and policy commentators, this cat-and-mouse game is an inevitable aspect of modern finance regulation.[155] They assume that the SEC's present resources are a hard limit on its ability to detect and deter abusive practices.[156] Thus they believe that the minimalist agenda now pursued by regulators[157] is the outer limit of enforcement activity that could be brought to bear.[158] More importantly, they also embrace the limited purview of state and federal regulators as a necessary check against overbearing regulation

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[154] Michael S. Knoll, *The Ancient Roots of Modern Financial Innovation: The Early History of Regulatory Arbitrage*, 87 OR. L. REV. 93, 94 (2008) ("The exploitation of regulatory inconsistencies is a major impetus for financial innovation. Indeed, it might be the primary impetus. There is a strong incentive to innovate around prohibited or disadvantaged transactions. These innovations are commonly referred to as regulatory arbitrage." (footnotes omitted)).

[155] *See* June Rhee, *Regulation by Hypothetical*, HARV. L. SCH. F. ON CORP. GOVERNANCE & FIN. REG. (Apr. 9, 2014, 9:00 AM), http://blogs.law.harvard.edu/corpgov/2014/04/09/regulation-by-hypothetical.

[156] *See* James J. Park, *Rules, Principles, and the Competition to Enforce the Securities Laws*, 100 CALIF. L. REV. 115, 127 (2012).

[157] *See* Lax & Neville LLP, *SEC Publishes 2015 Examination Priorities*, N.Y. SEC. LAW. BLOG (Feb. 6, 2015), http://www.newyorksecuritieslawyerblog.com/2015/02/sec-publishes-2015-examination-priorities.shtml?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+NewYorkSecuritiesLawyerBlogCom+%28New+York+Securities+Lawyer+Blog%29.

[158] *See* Harvey L. Pitt & Karen L. Shapiro, *Securities Regulation by Enforcement: A Look Ahead at the Next Decade*, 7 YALE J. ON REG. 149 (1990).

stifling financial innovation.[159] For the mainstream, HFT is a very valuable, fragile new technology, which unwise legal intervention could inadvertently deform or crush.

This Section challenges mainstream thought on HFT, pursuing both an immanent critique (which takes as given the values and goals of the mainstream) and a transcendent critique (proposing alternative values and goals). Section A describes the necessary enforcement prerequisites for even the minimalist agenda pursued by regulators. It demonstrates that, even if we take as given the desirability of a cautious, go-slow approach to HFT, regulators would need to deploy far more resources to detect and deter abusive market practices.[160] The theory of deterrence here, as in so much of finance regulation, is off. It makes no sense to expect abusive traders to step back from illegal strategies if the chance of being caught is exceptionally low, and the penalty for being caught does not involve jail time or a significant dent to their personal net worth. More intense deployment of resources could at least alter the calculus on the probability of being caught. Moreover, such a move is scarcely unprecedented: health sector regulators have creatively deployed contractors as force multipliers, and their approach could also be pursued in finance.

Section B takes on the second set of assumptions in the mainstream literature on HFT, focusing on the alleged value of the practice and the purported need to protect it from regulation. HFT is just as easily characterized as an intensification of baleful trends toward short-termism—indeed, as their *reductio ad absurdum*. Developing an alternative rule set driving markets toward better assessments of value is imperative.

A.   *The Preconditions for Pursuing a Minimalist Agenda*

Finance regulators can, at present, fully pursue only egregious cases. A key rationale for regulatory reticence is the resource differential between cash-strapped agencies and prosecutors on the one hand and financial firms on the other. The finance sector has billions of dollars at its disposal to fight off lawsuits (and to lobby for legislation and rules that tilt the playing field in its favor). Consider the SEC's budget—a

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159 *See generally* LUKE A. STEWART, INFO. TECH. & INNOVATION FOUND., THE IMPACT OF REGULATION ON INNOVATION IN THE UNITED STATES: A CROSS-INDUSTRY LITERATURE REVIEW 19 (2010), *available at* http://www.iom.edu/~/media/Files/Report%20Files/2011/Health-IT/Commissioned-paper-Impact-of-Regulation-on-Innovation.pdf.

160 Private litigants are already pursuing this position in court. Mark Gongloff, *Lawsuit: Incompetent SEC Struggles to Rein in High-Speed Trading Fraud*, HUFFINGTON POST (Nov. 24, 2012, 5:12 AM), http://www.huffingtonpost.com/mark-gongloff/sec-high-speed-trading-fraud_b_1909821.html.

mere $1.5 billion or so, which is less than the *personal fortunes* of some of the individuals involved in the thousands of matters it must consider each year.[161] Institutions are orders of magnitude richer.[162] The chair of the agency, Mary Jo White, testified to Congress in 2013 that its "current level of resources is not sufficient to permit the S.E.C. to examine regulated entities and enforce compliance with the securities laws in a way that investors deserve and expect."[163] That bland assessment barely does justice to the bleak realities at resource-starved agencies.[164]

Beleaguered by complex and ever-changing algorithmic strategies, finance regulators triage matters as best they can.[165] Many knowledge workers feel "behind the curve" when their computers are three years out of date, but the chair of the SEC admitted in 2010 that her agency's "technology for collecting data and surveilling our markets is often as much as two decades behind the technology currently used by those we regulate."[166] If budget cutting continues, the SEC's ability to even commence preliminary investigations in a wide range of cases will be undermined.[167]

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[161] *Testimony Before the Subcomm. on Fin. Servs. & Gen. Gov't: Comm. on Appropriations*, 113th Cong. 1 (2013) (statement of Mary White, Chair, U.S. Sec. & Exch. Comm.), *available at* http://appropriations.house.gov/uploadedfiles/hhrg-113-ap23-wstate-whitem-20130507.pdf; Mary L. Schapiro, Chairman, U.S. Sec. & Exch. Comm'n, Statement Concerning Agency Self-Funding (Apr. 15, 2010), *available at* http://www.sec.gov/news/speech/2010/spch041510mls.htm; Mary L. Schapiro, Chairman, U.S. Sec. & Exch. Comm'n, The Consumer in the Financial Services Revolution (Dec. 3, 2009), *available at* http://www.sec.gov/news/speech/2009/spch120309 mls.htm; Kara Scannell, *Senators Say No to SEC Self-Funding*, WALL ST. J. (Apr. 28, 2010), http://blogs.wsj.com/washwire/2010/04/28/senators-say-no-to-sec-self-funding.

[162] Compare the SEC budget and John Paulson's multi-billion dollar fortune, described in GREGORY ZUCKERMAN, THE GREATEST TRADE EVER: THE BEHIND-THE-SCENES STORY OF HOW JOHN PAULSON DEFIED WALL STREET AND MADE FINANCIAL HISTORY 252 (2009–10) (on Paulson's shorting of CDOs based on RMBs); *see also* DAVID ROTHKOPF, POWER, INC.: THE EPIC RIVALRY BETWEEN BIG BUSINESS AND GOVERNMENT—AND THE RECKONING THAT LIES AHEAD (2012) (comparing the relative discretionary spending power of firms and governments).

[163] Ben Protess, *White Makes Case for Bigger S.E.C. Budget*, N.Y. TIMES (May 7, 2013), http://dealbook.nytimes.com/2013/05/07/white-makes-case-for-bigger-s-e-c-budget   (internal quotation marks omitted).

[164] *See* James B. Stewart, *As a Watchdog Starves, Wall Street is Tossed a Bone*, N.Y. TIMES (July 15, 2011), http://www.nytimes.com/2011/07/16/business/budget-cuts-to-sec-reduce-its-effectiveness.html.

[165] While a consolidated audit trail is critical to the monitoring necessary here, the SEC was only "considering" it in 2011. Bonnie Kavoussi, *SEC May Monitor High-Frequency Trading with Consolidated Audit Trail*, HUFFINGTON POST (Dec. 10, 2011, 5:12 AM), http://www.huffingtonpost.com/2011/10/10/sec-high-frequency-trading_n_987378.html.

[166] Mary Schapiro, Chairman, U.S. Sec. & Exch. Comm., Opening Statement at the SEC Open Meeting: Consolidated Audit Trial (May 26, 2010), *available at* http://www.sec.gov/news/speech/2010/spch052610mls-audit.htm.

[167] *See* Ben Protess, *U.S. Regulators Face Budget Pinch as Mandates Widen*, N.Y. TIMES DEALBOOK (May 3, 2011), http://dealbook.nytimes.com/2011/05/03/u-s-regulators-face-budget-pinch-as-mandates-widen/?reftodayspaper.

Entities that are relatively well-funded—such as the FINRA—are even less likely to engage in bold policing of the markets than the SEC. One recent study found that FINRA's regulation of investment bankers actually failed.[168] While many high-frequency traders are not as well-positioned as investment bankers in the hierarchy of Wall Street power players, there are enough at relatively "untouchable" institutions to ensure a minimalist approach endures.

Fortunately, there are a few positive trends in the other direction. The Dodd-Frank Act of 2010 empowered an Office of Financial Research (OFR) within the U.S. Department of the Treasury to improve regulation by illuminating the overall state of financial markets.[169] The OFR collects and analyzes details of financial transactions in order to spot "systemic risk" (that is, patterns of bets that threaten to undermine the entire financial system).

OFR analysts focus on measuring financial risk, liquidity, and the potential for systemically destabilizing events, such as extreme price volatility unconnected to market fundamentals. Privy to some of the most sensitive data in financial markets, the OFR can send early warning signs to financial regulators. By assessing the state of the financial system as a whole, it should provide a critical new source of knowledge to regulators long kept in the dark. The OFR is serious about its work, fully acknowledging that finance recordkeeping may have to change to promote systemic stability:

> The data simply may not exist in the form needed for monitoring purposes. In that case, the Office [must] define data requirements, evaluate the feasibility and difficulty of obtaining the data, identify the best way to fill the gap, and develop a collection strategy. If the data do exist, they may not be accessible due to confidentiality, privacy, or data-sharing limitations. The data may be inadequate because they are not detailed enough for analysis, focused on the wrong items, too limited in scope, or of poor quality. In addition, the data may be impossible to compare or aggregate because of a lack of data standards.[170]

The last point—about data standards—is particularly troubling. The OFR itself is now setting standards known as Legal Entity Identifiers.[171] These would set a consistent name or number for the

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168 Andrew F. Tuch, *The Self-Regulation of Investment Bankers*, 83 GEO. WASH. L. REV. 101 (2014).

169 Jennifer S. Taub, *Great Expectations for the Office of Financial Research*, *in* WILL IT WORK? HOW WILL WE KNOW? THE FUTURE OF FINANCIAL REFORM 23 (Michael Konczal ed., 2011).

170 OFFICE OF FIN. RESEARCH, 2013 ANNUAL REPORT 72 (2013), *available at* http://financialresearch.gov/annual-reports/files/office-of-financial-research-annual-report-2013.pdf.

171 *See, e.g.*, Statement on Legal Entity Identification for Financial Contracts, 75 Fed. Reg. 74146, 74146–48 (Nov. 30, 2010).

entities engaged in various financial transactions, and are no doubt valuable. But the OFR has little to no ability to use monetary incentives to lure finance firms to adopt uniform standards.

Other regulators are trying to help here.[172] CFTC and SEC staff conclude "that current technology is capable of representing derivatives using a common set of computer-readable descriptions[, which] are precise enough to use both for the calculation of net exposures and to serve as part or all of a binding legal contract."[173] Such technology could also help track HFT strategies. As with the SEC's Consolidated Audit Trail,[174] which tracks trading, the idea here is to develop methods not merely for real-time monitoring of troubling developments, but also for red-flagging the most problematic trading strategies.[175]

Admittedly, the complexity of modern finance has led some to despair of ways to detect destabilizing or potentially fraudulent behavior before it balloons into disastrous misallocations of capital. Given regulators' fragmented authority, the slow implementation of Dodd-Frank, and the pressure of budget cuts, it may seem like a lost cause to even try to monitor the most cutting edge technology at financial institutions.[176]

Thus we should not be surprised to see Australian regulators discussing pre-trade filters on HFT, to suspend, limit or prohibit an

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[172] U.S. Sec. & Exch. Comm. (SEC) & U.S. Commodity Futures Trading Comm. (CFTC), Joint Study on the Feasibility of Mandating Algorithmic Descriptions for Derivatives (Apr. 7, 2011), *available at* http://www.sec.gov/news/studies/2011/719b-study.pdf.

[173] *Id.* Unfortunately, after considering the vagaries of accounting, securitization, and credit rating described above, it is difficult to credit the SEC's optimism here. Just as the FDIC's hypothetical resolution of Lehman "amused many by its naiveté," the staff appears to be promoting an aspiration as a likely achievement. Stephen J. Lubben, *Resolution, Orderly and Otherwise: B of A in OLA*, 81 U. Cin. L. Rev. 485, 485–86 (2012) ("The Federal Deposit Insurance Corporation . . . , keen to demonstrate its competency to wield the new powers given it under Dodd-Frank, rushed to produce a hypothetical resolution of Lehman that amused many by its naiveté."); Surden, *supra* note 20.

[174] *See, e.g.*, Press Release, U.S. Sec. & Exch. Comm., SEC Approves New Rule Requiring Consolidated Audit Trail to Monitor and Analyze Trading Activity (July 11, 2012), *available at* http://www.sec.gov/news/press/2012/2012-134.htm.

[175] They will face resistance. One witness called by House Republicans characterized OFR monitors as "Soviet-style central planners." *Oversight of the Office of Financial Research and the Financial Stability Oversight Council: Hearing Before the Subcomm. on Oversight and Investigations of the H. Comm. on Fin. Servs.*, 112th Cong. 83 (2011) (prepared testimony of Professor Nassim Taleb).

[176] Naysayers doubt the government's capacity to comprehensively surveil black box firms like HFT traders. But when the stakes are high enough, Washington is quite capable of approaching data-driven omniscience. If there is any take-home message of the parade of Snowden revelations about the NSA, it is that nearly *everything* can be recorded—even computers disconnected from the Internet, foreign leaders' medical records, or video games on a phone. Even tools that ostensibly encrypt data appear to be compromised by the agency. This is yet another reminder that arguments ostensibly about government's *capacity* to perform some regulatory function are, more often than not, ultimately judgments on the wisdom or value of allocating sufficient resources to that function. *See, e.g.*, Michael Rich, *Should We Make Crime Impossible?*, Harv. J.L. & Pub. Pol'y 796, 816–18 (2013).

order or series of orders from automated processing that would "interfere with the efficiency and integrity of the market."[177] The effort here is precautionary, not post-hoc. Surveillance is already so pervasive that predictive analytics can forecast "precrime" or "previolation" activity. The next step is to stop it before it happens.

B.   *Toward a Substantive Finance Policy Agenda*

Automated trading has already roused deep concerns. Federal watchdogs are overwhelmed and overmatched when it comes to the Internet and finance firms. The budget of finance regulation is a *fraction* of what is now invested in intelligence gathering. It is time for a rebalancing. The migration of monetary recordkeeping to Internet-enabled computer databases can either retard or enhance the ability of regulators to detect and deter fraud and threats to financial stability.[178] The question is whether we begin to rationalize the threat assessments of the intelligence apparatus to include financial crimes and instability— or continue to pretend that present patterns of regulation can stave off clear and present danger to social order.

Law is *constitutive* of so-called financial markets, not some mere side constraint on them.[179] The "products" traded are very little more than legal recognitions of obligations to buy or sell, own or owe. Trading patterns rapidly adopt to changing legal rules—as evidenced by the rise of HFT itself. For example, consider proposals to regulate access to co-location, in wake of the HFT arms race to place servers as close as possible to trading hubs. Currently, only those players with the most money can afford to have their servers placed closest to the exchanges' servers. A rule favoring more equal access to co-location might reduce unfairness resulting from this zero-sum race to fast access.[180]

If that kind of rulemaking appears too complex or contested, another proposal would also solve many problems arising out of HFT:

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[177] Jeremy Grant, Australia Clamps Down on *'Algo' Trading*, FIN. TIMES, Aug. 13, 2012, at B1.

[178] *See* Matt Krantz, *Computerized Stock Trading Leaves Investors Vulnerable*, USA TODAY (July 9, 2010), http://www.usatoday.com/money/markets/2010-07-09-wallstreetmachine08_CV_N.htm.

[179] "So-called" because they are not merely markets—they are always already creations of markets and states. The only way trading happens is because an intricate set of rules governs and defines nearly all aspects of debt, equity, derivatives, and currency exchange. Thus the term "exchange" (commonly used in health care after the passage of the Affordable Care Act) might be a more accurate descriptor of the spaces of trading in finance. However, this Article will follow the dominant nomenclature of financial "markets."

[180] Cognizant of this, the CFTC proposed a rule in June 2010 requiring uniform access to co-location facilities. CFTC-SEC report, *supra* note 88, at 67. The proposed new version of the MiFID would likewise require equitable co-location practices.

namely, a very small financial transactions tax.[181] Trivial from the perspective of those who make, say, dozens of trades per day, a tax of a penny per trade would be devastating for those who use bots to execute millions. The European Union has already proposed such an intervention.[182] Top economists have also supported it.[183] A financial transactions tax would deter the complex trading schemes behind some black box finance, and the volatility they engender.

For finance traditionalists, stepped up regulatory interventions or taxation are troubling because they are alleged to distort financial markets.[184] Their implicit normative lodestar is the legitimacy of the present in contrast to the presumed illegitimacy of a reshaped process and purpose for trading.[185] Were there societal consensus on the value of present trading practices, they might have a point. However, prominent economists, politicians, and even the public at large have expressed suspicion about the real value of current financial sector activities.[186]

The rise of HFT has created enormous uncertainty about trading patterns in equities,[187] and now threatens to remake other markets. HFT thrives on the very uncertainty and insecurity it generates.[188] The more its tactics spread, the more the remaining, non-HFT traders must consider adopting HFT methods.

This troubling dynamic could be upended by relatively straightforward changes in trading rules. Eric Budish, an associate professor of economics at the University of Chicago, has argued that "we should move from a continuous time market to one of discrete

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[181] Jim Corkery & Kristen Zornada, *High-Frequency Trading and a Financial Transactions Tax*, 22 REVENUE L.J. 1, 8 (2012).

[182] Press Release, European Comm'n, Financial Transaction Tax Under Enhanced Cooperation: Commission Sets Out the Details (Feb. 14, 2013), *available at* http://europa.eu/rapid/press-release_IP-13-115_en.htm; *cf.* Andrew Walker, *What is a Tobin Tax?*, BBC (Nov. 2, 2011), http://www.bbc.co.uk/news/business-15555812 (describing the rationale and purpose of a tax designed to slow the pace or decrease the volume of financial transactions).

[183] John Dillon, *An Idea Whose Time Has Come: Adopt a Financial Transactions Tax*, KAIROS CAN. (June 24, 2010), http://www.kairoscanada.org/sustainability/global-finance/kairos-briefing-paper-24-an-idea-whose-time-has-come-adopt-a-financial-transactions-tax.

[184] *See* JOANNA LEDGERWOOD, MICROFINANCE HANDBOOK: AN INSTITUTIONAL AND FINANCIAL PERSPECTIVE 21 (1998) (noting that repressive regulation can distort financial markets); Rebecca S. Rudnick, *Who Should Pay the Corporate Tax in a Flat Tax World?*, 39 CASE W. RES. L. REV. 965, 1224 (1989) (stating tax incentives can distort the risk return profile for financing); Igor Mauler Santiago, *Free Competition: How Tax Evasion and Tax Competition Distort Markets – The Brazilian Perspective*, TAXBLOG (Aug. 24, 2012), http://taxblog.com/igormauler/free-competition-how-tax-evasion-and-tax-competition-distort-markets-the-brazilian-perspective.

[185] *See* Tim Worstall, *Adam Smith Explains Why High Frequency Trading Doesn't Need To Be Regulated*, FORBES (Mar. 30, 2015, 8:23 AM), http://www.forbes.com/sites/timworstall/2015/03/30/adam-smith-explains-why-high-frequency-trading-doesnt-need-to-be-regulated.

[186] *See* Prewitt, *supra* note 40, at 161.

[187] Mi Hyun Yoon, *Trading in a Flash: Implication of High-Frequency Trading for Securities Regulators Worldwide*, 24 EMORY INT'L L. REV. 913 (2010).

[188] Lin, *supra* note 8, at 692.

time. Perhaps once per second or once per 100 milliseconds."[189] For example, orders arriving within one second of one another could be treated the same. If there were not enough shares to allocate to those orders, rules could specify how to divide them, or process order cancellations.

More creative alternatives are also available. Former SEC acting Chair Elisse B. Walter mooted the idea of requiring that all orders remain open for a minimum period of time after being entered, so as to ensure that whoever enters a buy/sell order actually intends for that order to be filled. That rule would eliminate certain trading practices that artificially push stocks higher by giving the impression of a significant underlying bid.[190] Walter's predecessor, Mary Schapiro, mentioned the idea of a resting time when she was still Chair of the SEC.[191] The European Union has already seriously considered "resting rules" for its exchanges.[192]

Nevertheless, regulators' present agenda for HFT entails a number of paradoxes. The purely procedural commitment to reduce unfair information advantage suggests a positive aspiration to eliminate latency for information transmission. But such an ideal bumps up against the laws of physics, as well as a largely privatized telecommunications grid.[193] Even light has a speed limit (186 miles per millisecond). There will always be natural distortions, or mere differences in distance that undermine the ideal of instantaneous communications and universally uniform presentations of bids and offers. The SEC and other regulators have substituted an impossible technical goal (a level playing field for information and order transmission) for more substantive engagement with investment patterns.

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[189] See Peter Chapman, *Exchanges and Traders Grapple Over HFT 'Problem,'* TRADERS MAG. ONLINE NEWS (Oct. 9, 2013), http://www.tradersmagazine.com/news/exchanges-and-traders-grapple-over-hft-problem-111603-1.html?ET=tradersmagazine:e2398:1406122a:&st=email&utm_source=editorial&utm_medium=email&utm_campaign=tm_weekly_101113.

[190] Walter, *supra* note 136. Her prepared remarks are also available at http://www.sec.gov/News/Speech/Detail/Speech/1365171492300#.UlheExDt5G0 ("The speed of quotes and subsequent cancellations—in today's market, where fractions of a second can be critical, this could give us a clearer picture of the potential effects of *rules like those requiring quotes to have a minimum time-in-force.*" (emphasis added)).

[191] *See* Jessica Holzer & Brett Philbin, *SEC is Looking at Quote Stuffing*, WALL ST. J., Sept. 7, 2010, at B5 ("Ms. Schapiro said the agency is considering requiring traders to hold orders open for minimum periods.").

[192] Philip Stafford, *Hard Bargaining Starts on MiFID II*, FIN. TIMES, Jun. 18, 2013, at B1 ("[The] 500 millisecond minimum resting times for orders may remain in the final text."). The Markets in Financial Instruments Directive (MiFID) is the EU's governing document with respect to trading.

[193] Keller, *supra* note 43, at 1462 (discussing co-location in general and how traders try and place their servers as close as possible to the exchanges' servers).

How did American financial regulators' focus on the sequence of information disclosure lead them into the paradoxical position of effectively trying to correct for tiny time differences that may arise out of variations in the location of traders and the communications equipment they can afford? To understand this present dilemma, it is helpful to turn back to the past. Modern securities law is rooted in the governmental response to the financial crisis of 1929 and its ensuing, devastating effects on the American and global economies. President Franklin Delano Roosevelt faced two distinctive points of view in coming to grips with the crisis. Progressive activists had been calling for more transparency and disclosure in the financial sector since the turn of the twentieth century. This was a primarily procedural remedy; the idea was to empower ordinary investors to make better decisions by ensuring that those soliciting investments disclosed sufficient information about their nature and likely risks.[194]

Another group of advisors pushed for a more substantive approach. Alarmed by the waste of capital in the 1920s in slapdash real estate development, they envisioned agencies intended to "direct the flow of new investment in private industry" toward socially useful projects.[195] For these critics, deception was a problem of the crisis, but not the *primary* problem (after all, who would complain about being deceived into an investment that provided reliable, sustainable returns)? Rather, they focused on wastes of resources. For example, Rexford Tugwell wanted a commission to influence the allocation of capital.[196] The corporate governance expert Adolf Berle advocated for an agency to "exercise a real control over undue expansion of groups of credit instruments," to reduce volatility and tame financialization.[197]

Unfortunately, the United States chose another path. Government pursued industrial policy, but investment markets were in large part left out of it.[198] By 1934, Roosevelt and Congress had decisively opted for disclosure-based, rather than substantive financial regulation. And for decades, the strategy appeared to be a serviceable one. Investor confidence was high, and an orderly flow of investment into the stock market was rewarded with an orderly, relatively high rate of return. Nevertheless, many critics have warned that the United States has

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[194] MARTIN MAYER, THE BANKERS: THE NEXT GENERATION 34 (1997).

[195] Henry T. C. Hu, *Too Complex to Depict? Innovation, "Pure Information," and the SEC Disclosure Paradigm*, 90 TEX. L. REV. 1601, 1614 (2012).

[196] BERNARD STERNSHER, REXFORD TUGWELL AND THE NEW DEAL 103 (1964).

[197] ADOLPH A. BERLE, POWER 188 (1969) ("Political officers can choose their objectives and, with some measure of predictability, create and use economic forces to produce desired results."); *see also* JOEL SELIGMAN, THE TRANSFORMATION OF WALL STREET: A HISTORY OF THE SECURITIES AND EXCHANGE COMMISSION AND MODERN CORPORATE FINANCE 40–41 (3d ed. 2003).

[198] VERNON RUTTAN, IS WAR NECESSARY FOR ECONOMIC GROWTH? (2009) (discussing the rise of defense-based industrial policy).

systematically underinvested in infrastructure, health information technology, antibiotics, public transportation, home health care, technical education, and many other sectors and services, particularly in the last few decades.[199] All these deficiencies suggest the need for a renewal of proposals for *substantive* channeling of investment by government.[200]

What would substantive financial regulation entail? Consider John Cassidy's commonsense explanation of liquidity:

> Liquidity refers to how easy or difficult it is to buy and sell. A share of stock in a company on the Nasdaq is a very liquid asset: using a discount brokerage such as Fidelity, you can sell it in seconds for less than ten dollars. A chocolate factory is an illiquid asset: disposing of it is time-consuming and costly. The classic justification for market-making and other types of trading is that they endow the market with liquidity . . . . But liquidity, or at least the perception of it, has a downside.[201]

Cassidy goes on to explain how liquidity can encourage short-termism and wreaks havoc with the planning of some entities. But some of those plans were, no doubt, unwise, and deserving of a withdrawal of support. Thus a critique of short-termism cannot itself merely be formal, blindly encouraging long-term investment. It must, instead, offer some evaluative metrics of projects that *deserve* long-term support. Where *should* long-term allocations of capital be directed?

Many economists and social scientists are offering compelling answers. For example, Mariana Mazzucato has underscored the importance of general-purpose technology that could dramatically expand the production possibilities frontier for our society.[202] She also documents the critical role green technology could play in disentangling the developed world from various negative effects of fossil fuels.[203] Even if shale gas and other alternative carbon sources have reduced the urgency of a green energy transition at present, there are still enormous opportunities to increase efficiency (and democratize energy access) in renewables.[204] There are also health crises caused by drug shortages,

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[199] ROBERT BRENNER, THE BOOM AND THE BUBBLE: THE US IN THE WORLD ECONOMY (2003); BRETT FRISCHMANN, INFRASTRUCTURE: THE SOCIAL VALUE OF SHARED RESOURCES (2012) (noting dismal report card for basic infrastructure ranging from aviation and bridges to levees and public parks to transit and wastewater).

[200] The federal government already has a large role in technology development. FRED BLOCK & MATTHEW KELLER, EDS., STATE OF INNOVATION: THE U.S. GOVERNMENT'S ROLE IN TECHNOLOGY DEVELOPMENT (2011). Learning from this role could inform further shaping of what is now misleadingly deemed "private finance."

[201] Cassidy, *supra* note 68, at 88.

[202] MAZZUCATO, *supra* note 13, at 196 (discussing a "systems perspective" for improving productivity).

[203] *Id.*

[204] JEREMY RIFKIN, THE ZERO MARGINAL COST SOCIETY 5 (2013).

particularly among antibiotics. Antibiotic resistance has been called a ticking time bomb by several authorities on health policy—but pharmaceutical firms have been slow to meet the challenge, given financial markets' consistent pressures on them (and firms generally) to allocate attention elsewhere.

Paul Krugman, Brett Frischmann, and Joseph Stiglitz have also provided compelling answers, focusing on infrastructure and basic research.[205] Finance scholars Robert Hockett and Saule Omarova have compellingly articulated precise policy and legal bases for such an intervention.[206] As they specify,

> [A National Infrastructure Bank] would seek to *amplify and optimize* the currently sub-optimal system of public-private cooperation in the area of infrastructure finance. . . . [A]n NIB can be viewed as an infrastructure-specific analogue to the home finance GSEs, as well as to various other forms of public-private partnership.[207]

Hockett and Omarova demonstrate that a "sustainable *national development strategy*" should be at the core of finance policy.[208]

Specific national development needs are clear, and have been noted by several leading social scientists. Robert Kuttner has creatively developed plans for professionalizing several occupations that are presently under-trained and under-paid.[209] Focused on home health aides and nursing home workers, a project like Kuttner's could flip the baby boom's aging from an economic threat to an economic boon capable of providing stable, sustainable jobs.[210] Professionalization could enhance the security and job satisfaction of many workers whose positions are now precarious and dull.

There will be controversy over such proposals. But without clear substantive answers to the question concerning finance, all we can reliably expect in the future is that capital will be allocated to whatever instruments lead to the highest fees for the self-serving intermediaries

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[205] FRISCHMANN, *supra* note 199; PAUL KRUGMAN, END THIS DEPRESSION NOW (2012); JOSEPH STIGLITZ, FREEFALL (2011).

[206] Hockett & Omarova, *supra* note 14.

[207] *Id.* at 44 (internal quotation marks omitted).

[208] *Id.* at 65 ("[T]he government is not merely an *exogenous* force acting *upon* private financial markets, in its traditional *supervisory or constitutive* capacity. The government is also an *endogenous* force acting *within* financial markets in a directly *participatory* capacity.").

[209] ROBERT KUTTNER, OBAMA'S CHALLENGE: AMERICA'S ECONOMIC CRISIS AND THE POWER OF A TRANSFORMATIVE PRESIDENCY 146 (2008) (developing plan to professionalize the "human-service economy").

[210] *Id.*

who now exercise power over the allocation of investment.[211] In that case, more capital will continue to be sunk into finance itself.[212]

The phenomenon of "finance financing finance" may seem a paradoxical betrayal of finance's function as an intermediary. But it accurately reflects the power of Wall Street over other sectors of the economy.[213] While Wall Street firms pride themselves on forcing managers in ordinary industries to cut costs and reduce wages, economist Thomas Philippon has confirmed that finance firms themselves are becoming more expensive.[214] HFT is a particularly worrisome aspect of this trend. It is conceivable that an excellent stock analyst may well "beat the market" (though finance theory in general and the efficient market hypothesis in particular suggest this is impossible).[215] But even if we grant that—to what end? We now live in an era when capital is extraordinarily concentrated.[216] The primary end of financial markets should not be trying to guarantee that the ninety-six percent of financial wealth held by the top quintile generates maximum returns for those owners.[217] They must have some plan for assuring positive outcomes for the other eighty percent of the population.[218] Otherwise, we should expect an ever-growing divergence between the main owners of capital and those whose primary income derives from labor.[219]

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[211] Fresh thinking in finance recognizes the importance of this substantive turn. *See, e.g.*, MELLOR, *supra* note 7, at 156 (discussing a "Green New Deal"); PETTIFOR, *supra* note 13, at 89 (discussing a "suite of policies for subordinating finance to the real economy").

[212] JAN TOPOROWSKI, THE END OF FINANCE: THE THEORY OF CAPITAL MARKET INFLATION DERIVATIVES, AND PENSION FUND CAPITALISM 131 (2000) ("The process of capital market inflation distorts . . . economic and social priorities by allowing finance to determine its own values.").

[213] Gautam Mukunda, *The Price of Wall Street's Power*, HARV. BUS. REV., June 2014, at 14.

[214] Thomas Philippon, Has the U.S. Finance Industry Become Less Efficient? On the Theory and Measurement of Financial Intermediation (Sept. 2013) (unpublished manuscript), *available at* http://pages.stern.nyu.edu/~tphilipp/papers/Finance_Efficiency.pdf.

[215] JOHN BOGLE, DON'T COUNT ON IT: REFLECTIONS ON INVESTMENT ILLUSIONS, CAPITALISM, "MUTUAL" FUNDS, INDEXING, ENTREPRENEURSHIP, IDEALISM, AND HEROES (2011).

[216] G. William Domhoff, *Wealth, Income, and Power*, WHO RULES AMERICA?, http://www2.ucsc.edu/whorulesamerica/power/wealth.html (last updated Feb. 2013) ("In the United States, wealth is highly concentrated in a relatively few hands. As of 2010, the top 1% of households (the upper class) owned 35.4% of all privately held wealth, and the next 19% (the managerial, professional, and small business stratum) had 53.5%, which means that just 20% of the people owned a remarkable 89%, leaving only 11% of the wealth for the bottom 80% (wage and salary workers). In terms of financial wealth (total net worth minus the value of one's home), the top 1% of households had an even greater share: 42.1%.").

[217] *Id.* (chart on financial wealth, which does not include housing).

[218] ANTHONY B. ATKINSON, INEQUALITY WHAT CAN BE DONE? 155 (2015) (on the need to share the returns to capital).

[219] THOMAS PIKETTY, CAPITAL IN THE TWENTY-FIRST CENTURY 25 (Arthur Goldhammer trans., 2014). Piketty's basic finding is that, absent extraordinary political interventions, the rate of return on capital (r) is greater than the rate of growth of the economy generally (g). Most persons support themselves primarily by wages—that is, what they earn from their labor. As capital takes more of economic output (an implication of r > g persisting over time), less is left for labor. *Id.*

To be sure, stable, sustainable returns for investors are commendable. But they are only possible in environment where some critical mass of investors are acting for the long-term, rather than trying to take advantage of moment-by-moment fluctuations in prices. Moreover, there must be some societal steering of capital towards sectors where it is underallocated, and away from places where it is overallocated.[220] And it is this thoughtful steering that HFT directly undermines.[221]

Moreover, to the extent that high-frequency traders are merely trading on the basis of others' actions, they are parasitic, making money from the market process itself rather than informed investment in the future. What are the costs of diverting more funds (and thus, human effort) to financialization? Macroeconomists J. Bradford Delong and Stephen Cohen calculate that:

> Over the past 15 years, the United States has half-consciously re-shaped its economy. The country shifted some 7 percent of its GDP out of manufacturing and added some 7 percent of GDP in the expansion of finance, insurance, and real estate transactions . . . . The communities of engineering practice and innovative technological development do move and emerge elsewhere as you shift labor from real engineering, which calculates stresses in materials and quantum tunneling in doped semiconductors, into financial engineering, which calculated delta-hedge decay and vega convexity for synthetic securities. It also means that you must create more and more debt so that other nations have the dollars to accumulate and not balance their trade—and yours.[222]

Endlessly trading and revaluing such debt (and equities) will not contribute to real living standards, and in fact has reduced them.[223]

HFT is a perfect match for a trading environment dominated by ever shorter time horizons. Equity markets are becoming ever less concerned with the real economy (for example, questions like, which company makes the most fuel-efficient cars? or even, which firm makes

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[220] HARTMUT ROSA & WILLIAM E. SCHEUERMAN, HIGH-SPEED SOCIETY: SOCIAL ACCELERATION, POWER, AND MODERNITY 25 (Hartmut Rosa & William E. Scheuerman eds., 2009) ("Globalizing capitalism's obsession with fast profits and quick turnover times conflicts with the necessities of long-term system reproduction, including its own natural and ecological presuppositions; fast capitalism meshes poorly with the fundamental rhythms of human existence, thereby engendering intense stress and unease in everyday life.").

[221] HARTMUT ROSA, SOCIAL ACCELERATION: A NEW THEORY OF MODERNITY 159 (2013) ("[A] democratic self-steering and self-binding of society . . . is dependent on cultural, structural, and institutional presuppositions that seem to be rapidly eroding in late modernity precisely as a consequence of social acceleration.").

[222] STEPHEN S. COHEN & J. BRADFORD DELONG, THE END OF INFLUENCE 146–47 (2010).

[223] ROBERT KUTTNER, THE SQUANDERING OF AMERICA: HOW THE FAILURE OF OUR POLITICS UNDERMINES OUR PROSPERITY 130–45 (2008) (connecting predatory finance to decline in living standards).

cars that customers will want to buy?) than with windows of opportunity for sudden arbitrage (for example, how do we buy thousands of shares of Ford milliseconds before a major pension fund buys them and drives up their price, and then sell them milliseconds later?).[224] HFT strategies may conduce to some abstract conception of liquidity, but they do not provide measurable gains to the *productive* functions of the economy.

Our high-speed financial system creates massive new risks for ordinary investors. Even if the Fed were to authorize an emergency infusion of liquidity to address an HFT-catalyzed crash, eventually the bill will come do. And it will only exacerbate extant moral hazard.

There should also be more public sector financial institutions, which might be warier of the stampede to tactics like HFT. Congress could permit post offices to offer banking services, providing a valuable low-cost option to the millions of "unbanked" Americans.[225] This is not a radical idea: the Bank of North Dakota has offered the state's farms and businesses loans for almost a century.[226] Public banking might also provide incentives for investments in the social good. And pension plans could emphasize old-fashioned "value investing" featuring clear commitments to comprehensible business plans.

CONCLUSION

Law enforcers should continue to pursue cases against exchanges and dark pools that misrepresent their own policies of protecting ordinary traders' information from early detection by high-frequency traders. That is clearly either a breach of contract or fiduciary duty. But an overall regulatory push merely to ensure that "everyone" gets certain critical information at the same time is probably misguided, without further effort to limit the role of infinitesimally small time increments in orders. Such a time equalization approach could conceivably work if all those trading were located in the same place, and had access to the same communications equipment. In reality, traders are located around the world, and communications technology constantly changes. High-frequency traders are constantly going to take advantage of some form

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[224] DOUG HENWOOD, WALL STREET: HOW IT WORKS AND FOR WHOM 156 (1998); Mukunda, *supra* note 213.

[225] Mehrsa Baradaran, *It's Time for Postal Banking*, 127 HARV. L. REV. F. 165 (2014); David Dayen, *The Post Office Should Just Become a Bank*, NEW REPUBLIC (Jan. 28, 2014), http://www.newrepublic.com/article/116374/postal-service-banking-how-usps-can-save-itself-and-help-poor.

[226] JASON JUDD & HEATHER MCGHEE, BANKING ON AMERICA: HOW MAIN STREET PARTNERSHIP BANKS CAN IMPROVE LOCAL ECONOMIES (2010).

of latency. Conceived in this way, the problem of HFT is that regulators will constantly be a step behind.

In response to the Great Financial Crisis of 2008 (and the lesser tremors evidenced in fiascos like the Flash Crash), finance experts have focused on matters of *structure* and *process*. The critical goal has been to assure that banks are less prone to fall like dominos due to interconnection. Market structure concerns also dominate present discussions of HFT, leading to a series of regulatory actions and proposals from legal academics expert in finance law and theory. Unfortunately, to implement their proposals well, we would need a far more robust regulatory apparatus. Moreover, questions of the *substance* of investment are far more important to rebuilding the real economy. Finance regulation disconnected from the concerns of the real economy is a partial field in both senses of the word: it is *biased* toward the interests of dominant finance intermediaries, and it is *incomplete*, ignoring perspectives crucial to its validity.

The main stated purpose of the financial sector is price discovery. If there are only a few people buying and selling a given company's stock, it can be very difficult to determine what the right price is. Whatever haggling takes place between the buyers and sellers may reflect the bargaining power of either side or random conditions of the negotiations rather than the actual value of the equity. Larger, impersonal markets are supposed to overcome this problem by spreading trades over multiple locations, involving diverse buyers and sellers. Sometimes the buyer may be desperate, and sometimes the seller might be. In the aggregate, this "noise" should cancel out as a clear price signal emerges.

Advocates for HFT claim its methods realize this ideal in equity markets. Their ultimate goal is to set exact and instantaneous prices on a wide array of financial instruments (and, ultimately, risks in general). Financial engineers claim that ever more rapid trading would mark a great triumph of human ingenuity, a technology of that vastly expands societal capabilities to plan and invest. But as we now know, the price discovery function has failed miserably in several noted cases. Complexity, malfeasance, and sometimes outright fraud made a mockery of the finely engineered financial future promised by quants.

Sadly, many workers who earnestly contribute to 401(k) plans mistake the unglamorous realities of algorithmic trading for the glitter of venture capital jackpots. Investors like to think of their money supporting brave innovators and entrepreneurs. But how many really know the ultimate destinations of their dollars? As Doug Henwood has shown, nearly all of the activity in the current stock market is transfers

of existing shares.[227] The trading simply reallocates claims to the future productivity of existing firms. Short time horizons steer money away from long-term, risky, but potentially far more productive projects like green energy and medical research. Finance's pervasive short-termism crowds out visionaries.

The grand illusion of contemporary finance is that shuffling claims to future wealth will somehow lead to a more productive economy. We should be wary of growing economic activity in trading, particularly when so much is driven by zero-sum games of communication advantage and information manipulation. The less HFT is regulated, the better chance its middlemen have to get rich not by adding to the sum total of goods and services created, but rather by setting up arms races.[228]

As Geoff Mulgan observes,

> If you want to make money, you can choose between two fundamentally different strategies. One is to create genuinely new value by bringing resources together in ways that serve people's wants and needs. The other is to seize value through predation, taking resources, money, or time from others, whether they like it or not.[229]

All too often, high-frequency traders choose the second strategy, using the latest in technology to innovate feints, deception, and sharp practices. A small financial transactions tax could end these malign effects, and revenue generated by it could fund more substantive aims for finance regulation. Finance can support the real economy, but only if law demands it do so.

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[227] HENWOOD, *supra* note 224, at 4 ("[M]ost of the trading in the stock market is of existing shares, not newly issued ones.").

[228] This arms race has affected ordinary investors. *See, e.g.*, Roberta S. Karmel, *IOSCO's Response to the Financial Crisis*, 37 J. CORP. L. 849, 892 (2012) (discussing how institutional investors who often manage ordinary investors' pension funds sought to hide their trades from high-frequency traders).

[229] GEOFF MULGAN, THE LOCUST AND THE BEE: PREDATORS AND CREATORS IN CAPITALISM'S FUTURE 52 (2013).