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Regulating Secondary Markets in the High Frequency Age: A Principled and Coordinated Approach

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REGULATING SECONDARY MARKETS IN THE HIGH FREQUENCY AGE: A PRINCIPLED AND COORDINATED APPROACH

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Technological developments in securities markets, most notably high frequency trading, have fundamentally changed the structure and nature of trading over the past 50 years. Policymakers both domestically and abroad now face many new challenges impacting the secondary market's effectiveness as a generator of economic growth and stability. Faced with these rapid structural changes, many are quick to denounce high frequency trading as opportunistic and parasitic. This article, however, instead argues that while high frequency trading presents certain general risks to secondary market efficiency, liquidity, stability, and integrity, the practice encompasses a wide variety of strategies, many of which can enhance, not inhibit, the secondary trading market's core goals.

This article proposes a regulatory model aimed at maximizing high frequency trading's beneficial effects on secondary market functions. The model's foundation, however, requires information. By analyzing more data on how high frequency traders interact with markets, regulators can assess the viability and scope of other potentially worthwhile measures targeting more general market threats. Likewise, regulators can determine who is in the best position to bear supervisory responsibility for particular trading activities: agencies, exchanges, traders, or some combination thereof. Crucially, the model also calls on regulators to share information on a global scale: trading no longer only affects a single exchange, a single asset class, or even a single country. By sharing information, global regulations become more informed, secondary market stability is enhanced, and regulatory arbitrage is minimized. In short, high frequency trading can be a force for good, but a principled and coordinated effort is required to ensure it fulfills that potential.

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INTRODUCTION

High frequency trading (HFT) evokes strong emotions on both sides of the political aisle.[1] New York State Attorney General Eric Schneiderman has called HFT "Insider Trading 2.0"[2] while Senator Elizabeth Warren simply branded it as "wrong."[3] CFTC Commissioner Scott O'Malia, a Republican, also expressed a concern that regulators do not have the tools necessary to supervise modern markets.[4] Given the structural revolution that has taken place in secondary markets over the past 25 years, these reactions are expected. HFT has caused volumes to swell[5] and

1. *Compare* Sam Mamudi and Dave Michaels, *Hillary Clinton Steps Into High-Frequency Debate with Tax Plan*, BLOOMBERG (Oct. 8, 2015), http://www.bloomberg.com/politics/articles/2015-10-08/hillary-clinton-steps-into-hft-controversy-with-tax-proposal; *with* Press Release, Senator John McCain, Statement by Senator John McCain on High-Frequency Trading Controversy (Apr. 1, 2014), http://www.mccain.senate.gov/public/index.cfm/2014/4/statement-by-senator-john-mccain-on-high-frequency-trading-controversy.

2. N.Y. State Att'y Gen. Eric Schneiderman, Remarks on High-Frequency Trading & Insider Trading 2.0, http://www.ag.ny.gov/pdfs/HFT_and_market_structure.

3. *See High Frequency Trading's Impact on the Economy: Hearing Before the Subcomm. on Sec., Ins. & Inv. of the S. Comm. on Banking, Hous. & Urban Affairs*, 113th Cong. 19-20 (2014) (Senator Warren stating HFT reminded her of "the scam in Office Space" by skimming "just a little bit of money from every trade in the hope that no one will complain").

4. *See, e.g.,* Silla Brush, *High-Speed Trades Outpace CFTC's Oversight, O'Malia Says*, BLOOMBERG (May 7, 2014), http://www.bloomberg.com/news/articles/2014-05-06/high-speed-trades-outpace-cftc-s-oversight-o-malia-says.

5. *Compare Market Turmoil; Averting Blizzard of Paper*, N.Y. TIMES (Oct. 25, 1987), http://www.nytimes.com/1987/10/25/us/market-turmoil-averting-blizzard-of-paper.html. (observing that trading volumes exceed 20 million shares for the first time) *with* Charles M. Jones, *What Do We Know About High Frequency Trading?* 45 (Columbia Bus. Sch. Research Paper No. 13-11, 2013) (stating today's markets routinely have a daily volume exceeding one billion orders).

spreads,[6] average trade sizes,[7] and average holding periods[8] to decrease just as dramatically. Investors can buy or sell securities at astounding speeds on trading platforms all across the globe, spurred by technological advancements that have brought market participants closer together than ever before.[9] As HFT firms spend millions of dollars every year to increase the speed at which they can trade,[10] one may worry that trading has become an end in itself, separating itself from the goods-and-services producing economy.

Yet many politicians and regulators forget that algorithmic trading, HFT's predecessor, grew out of perceived necessity. In deciding to automate markets, regulators aimed to create and enhance price competition on and between market centers, remedying technological issues that actively inhibited securities exchanges' operations.[11] Regulators viewed algorithmic trading as the glue holding these new markets together, serving to both connect and protect investors in ways human market makers could not.[12]

In many respects, regulators accomplished these goals. Empirical evidence suggests that HFT, by placing competitive pressure on brokerage fees and spreads, is at least partly responsible for reducing transaction costs.[13] Other studies find that HFT also improves pricing accuracy in secondary markets.[14] By paying constant attention to all order flow in a given security, these studies suggest, HFT can form better estimates of that security's price than can traditional human market makers. Similarly, other evidence suggests that HFT's constant buying and selling in the market

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6. *See* DIV. OF TRADING & MKTS., U.S. SEC. & EXCH. COMM'N, EQUITY MARKET STRUCTURE LITERATURE REVIEW, PART II: HIGH FREQUENCY TRADING 23-24 (2014), https://www.sec.gov/marketstructure/research/hft_lit_review_march_2014.pdf.

7. *See, e.g.*, Jeremy Grant; *Smaller orders breed dark pools and higher post-trade costs*, FIN. TIMES (Feb. 22, 2010), http://www.ft.com/intl/cms/s/0/768b4e12-1f52-11df-9584-00144feab49a.html#axzz42Qnky213 (noting average order sizes on the New York Stock Exchange decreased from $19,400 in 2005 to $6,400 in 2010).

8. *See* SCOTT PATTERSON, DARK POOLS 46 (2012).

9. At the end of the 1990s, it took 20 seconds to complete a trade. By 2011, that number fell to under 200 microseconds. Now, most trades can be executed in 10 microseconds or less, with further enhancements sure to follow. *See* Andrew G. Haldane, Exec. Dir. Fin. Stability, The Race to Zero, Speech Given at International Economic Association Sixteenth World Congress 4-5 (July 8, 2011).

10. For instance, in 2010 twenty HFT firms paid an average of $140 million to access an ultra-fast fiber-optic cable connection between exchange servers in New Jersey and Chicago. *See* Alan Tovey, *High-Frequency Trading: When Milliseconds Mean Millions*, TELEGRAPH (Apr. 2, 2014), http://www.telegraph.co.uk/finance/newsbysector/banksandfinance/10736960/High-frequency-trading-when-milliseconds-mean-millions.html.

11. *See infra* Part I.A.

12. *Id.*

13. *See* DIV. OF TRADING & MKTS, U.S. SEC. & EXCH. COMM'N, *supra* note 6.

14. *See, e.g.*, Jonathan Brogaard, Terrence Hendershott, & Ryan Riordan, *High-Frequency Trading and Price Discovery*, 27 REV. FIN. STUD. 2267 (2014); Ray Riordan & Andreas Storkenmaier, *Latency, Liquidity and Price Discovery*, 15 J. FIN. MKTS. 416 (2012).

has bolstered liquidity[15] and reduced overall volatility levels.[16] Taken as a whole, these studies suggest that HFT benefits the broader economy by lowering many issuers' costs of capital.[17]

Not all HFT-related concerns, however, are ill founded. It is contestable, for instance, that HFT conclusively improves asset pricing. Many HFT strategies trade based only on short-term, non-fundamental information, meaning they contribute little, if anything, to security price accuracy and allocative efficiency.[18] Meanwhile, HFT's purported liquidity enhancements are often selective, fleeting, and even illusory. Most HFT firms have no obligation to maintain "fair and orderly markets."[19] Unlike market makers of the past, HFT firms can withdraw from the market during periods of market stress, causing a dearth of liquidity when most needed.[20] Likewise, studies show that HFT only boosts the liquidity of stocks that were generally liquid to begin with, leaving other securities frustratingly illiquid.[21] Equally concerning, there is a widespread belief that HFT runs unchecked as exchanges cater to its needs at the expense of other investors.[22] This belief has undermined investor confidence, driving some retail investors out of the market entirely.[23]

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15. Liquidity refers to the extent the secondary market allows securities to be bought and sold at stable prices. *See* Terrence Hendershott, Charles M. Jones, & Albert Menkveld, *Does Algorithmic Trading Improve Liquidity?*, 66 J. FIN. 1, 30-31 (2011).

16. Volatility refers to the frequency and magnitude of stock price fluctuations. Many HFT strategies risk trading with counterparties that possess more or better knowledge about a given security. This threat, known as adverse selection risk, generally incentivizes HFT to update its orders often to reflect the most current information. In theory, more frequent quoting allows investors to successfully trade at more accurate and stable prices, reducing volatility. Michelle Price, *High-Frequency Trading Shown to Have Positive Impact*, WALL ST. J., (Aug. 17, 2011), http://www.wsj.com/articles/SB10001424053111903392904576512250007216020 (reporting on conclusions of study conducted by Australia's Capital Markets Cooperative Research Centre); *see also* Christina McEachern Gibbs, *HFT Does Not Create Volatility, Says Buy Insider*, WALL STREET & TECHNOLOGY (Aug. 6, 2009), http://www.wallstreetandtech.com/trading-technology/hft-does-not-create-volatility-says-buy-sider/d/d-id/1262315?.

17. *Id*.

18. Andrei A. Kirilenko et al., *The Flash Crash:* The Impact of High Frequency Trading on an Electronic Market 37-38 (May 26, 2011) (unpublished manuscript), http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.409.319&rep=rep1&type=pdf.

19. *See, e.g.*, Hendershott et al., *supra* note 15.

20. *Id.;* Jennifer Victoria Cristine Dean, *Paradigm Shifts & Unintended Consequences: The Death of the Specialist, the Rise of High Frequency Trading, & the Problem of Duty-Free Liquidity in Equity Markets*, 8 FLA. INT'L U. L. REV. 217 (2012).

21. *See, e.g.*, Elvis Picardo, *Top Stocks High-Frequecy Traders (HFTs)* Pick, INVESTOPEDIA (June 2, 2014), http://www.investopedia.com/articles/active-trading/053010/top-stocks-high-frequency-traders-hfts-pick.asp.

22. *See* Merrin, *High Frequency Trading*, THE ECONOMIST (Mar. 7, 2012), http://www.economist.com/debate/days/view/816; *see also* Lanier v. BATS Exch., Inc., 105 F. Supp. 3d 353, 355 (S.D.N.Y. 2015) ("[S]everal lawsuits against [certain] exchanges have been filed . . . alleging that by offering such advantages to high-frequency traders, the exchanges have violated various federal statutes and regulations . . . ").

23. *Id.*

On a more general level, HFT poses substantial risks to secondary market stability. Regulation National Market System (Reg. NMS), enacted in 2005, purported to establish a single national market system where the shares of any company could trade on any exchange.[24] The new system tried to strengthen, not weaken, markets by increasing transparency, efficiency, and fairness.[25] But as severe market swings, or "flash crashes," become an increasingly regular occurrence, markets appear more interconnected and prone to disruptions than ever before.[26] The effects of these disruptions are not limited to domestic trading, either: as more issuers' cross-list their stocks in multiple countries and more HFT firms establish operations in various jurisdictions, these risks can only increase.

Given how little regulators know about how HFT strategies actually work in practice, addressing these risks is hugely important. But this article argues that this information deficit is also why regulators must proceed cautiously. Though policymakers have made significant efforts to address HFT-related issues already, many are overbroad, target the wrong problems, or overlook ways to harness HFT to improve key secondary market functions. All HFT is not created equal; many HFT strategies, like market-making,[27] improve market stability and benefit investors while other strategies, like momentum ignition and spoofing,[28] are aggressive, predatory, and value-diminishing. Regulators must encourage the former and discourage the latter.

As a first step, regulators must expand their knowledge base. As primary market supervisors, they must be able to capably and reliably distinguish good HFT from bad. Registering HFT firms, collecting and analyzing more complete trading data, imposing disclosure requirements, and stress-testing HFT strategies are all useful measures that will shed light on increasingly opaque and complex secondary markets. Using this information, regulators can then assess the viability and scope of other potentially worthwhile measures, such as adopting on-demand batch auction systems, altering minimum stock tick sizes, dynamically setting maker-taker liquidity rebates, and setting order message limits. Likewise, regulators will be able to determine who can best bear supervisory responsibility for particular HFT activities: agencies, exchanges, other non-HFT traders, HFT firms, or some combination thereof.

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24. Regulation NMS, Exchange Act Release No. 51,808, 70 Fed. Reg. 37,496 (June 29, 2005) (adopting release) (codified at 17 C.F.R. §§242.600-13).

25. *See infra* Part I.A.

26. *See, e.g.*, Dave Michaels, *Exchanges, Regulators Scramble to Fix ETFs After August Rout*, BLOOMBERG (Sept. 17, 2015), http://www.bloomberg.com/news/ articles/2015-09-17/exchanges-regulators-scramble-to-fix-etfs-after-august-rout; Scott Paterson, *Breakdown: A Glimpse Inside the 'Flash Crash'*, WALL ST. J. (June 10, 2012), http://www.wsj.com/articles/SB10001424052702303296604577454330066039896.

27. *See infra* Part I.C.1.

28. *See infra* Part I.C.3.

U.S. regulators must not hoard this information. It is no coincidence that HFT firms trade cross-listed stocks far more actively than non-cross-listed stocks.[29] As the globalization of secondary markets continues, regulators would be wise coordinate their data gathering and registration processes, fostering a more comprehensive understanding of exactly how HFT strategies affect investors and global markets. Sharing data will have other beneficial effects as well, like facilitating the quick and effective resolution of cross-border enforcement issues and informing more consistent, high-quality regulations that reduce potential regulatory gaps. Such coordination could also include synchronized responses to severe secondary market disruptions, promoting cross-market stability and reducing systemic risk.

This article proceeds as follows. Part I lays out basic information about markets and HFT for those unfamiliar with the topic, explaining at a high level HFT's historical origins, how modern securities markets work, and how common strategies employed by HFT operate. Part II then explains why secondary markets are beneficial to the economy. Based on this discussion, the article concludes by establishing principles that should guide regulators as they think through the existing secondary market regulatory framework as it applies to HFT. The application of these principles, and a critical analysis of how well regulators' current efforts adhere to these principles, will be the topic of a future article, to appear in Volume 6, Issue 2 of this publication.

I. High Frequency Trading and Secondary Markets

From the outset, it is important to understand how secondary markets work and how HFT fits into their structure. Although the following examples involve stocks, HFT is prevalent in secondary markets for most other asset classes as well.[30] This section demonstrates that regulators viewed algorithmic trading, of which HFT is a subset, as a tool capable of fixing significant market infrastructure issues. Following that, this section describes how modern secondary markets currently function and examines how several commonly employed HFT strategies operate.[31]

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29. Kiril Alampieski & Andrew Lepone, High Frequency Trading in UK Equity Markets: Evidence Surrounding the US Market Open, (April 2013) (unpublished Ph.D. research paper, University of Sydney) (on file with the Capital Markets Cooperative Research Center).

30. *See, e.g.*, John Rennison, *High-Frequency Traders: Bond Market Scourge or Saviour?*, Fin. Times (Sept. 1, 2015), http://www.ft.com/intl/cms/s/0/ab70bdf2-4507-11e5-b3b2-1672f710807b.html#axzz42Qnky213.

31. For a helpful discussion of some basic vocabulary describing different types of orders and specific services offered by trading venues to these traders, see Merritt B. Fox, Lawrence R. Glosten, and Gabriel V. Rauterberg, *The New Stock Market: Sense and Nonsense*, 65 Duke L. J. 191 (2015).

A. *Historical Origins of High Frequency Trading*

Before 1975, most equity trading in the United States took place on the New York Stock Exchange (NYSE). The NYSE was composed of brokerage firms who, upon joining the exchange as members, agreed to trade assigned stocks on commission. These firms employed "specialists" who in turn fulfilled these firms' agreed-on obligation to "maintain fair and orderly" markets, standing ready to buy or sell these stocks throughout the trading day.[32] To this effect, specialists maintained stock inventories and continuously posted quotes of prices at which they were willing to buy or sell.[33] Working as intermediaries, these firms pocketed the spread—the difference between the prices at which they were willing to buy and sell the stock—as profit.[34]

As members, these firms also agreed to abide by certain operating restraints. One restraint involved fixing minimum commission rates. In the Buttonwood Tree Agreement of 1792, the original pact from which NYSE emerged, members agreed to "not buy or sell from this day for any person whatsoever, any kind of Public Stock at a less rate than one-quarter percent Commission."[35] This structure aimed to reduce competition among its members, although brokers still engaged in other forms of non-price competition like free research or services.[36] Nonetheless, commissions on NYSE remained non-competitive for nearly two centuries.[37]

Starting in the late 1960s, societal and technological forces began exerting pressure on the NYSE business model and pricing structure. First, trading volumes increased exponentially. In 1968, daily trading volume on the NYSE exceeded twenty million shares for the first time.[38] Unfortunately, at that time the NYSE still operated on a paper-based system, meaning traders had to transport physical stock certificates (along with an average of thirty-three administrative forms) from one investor to another

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32. *See, e.g.*, Nan S. Ellis, Lisa M. Fairchild, and Harold D. Fletcher, *The NYSE Response to Specialist Misconduct: An Example of the Failure of Self-Regulation*, 7 BERKELY BUS. L.J. 102, 109-11, 113 (2010).

33. *Id.* at 104 n.11.

34. *Id.* at 111.

35. *See* Gordon v. NYSE, 422 U.S. 659, 663 (1975) (quoting the agreement).

36. Jeffery A. Eisenach & James C. Miller III, *Price Competition on the NYSE*, AEI J. GOV'T & SOC'Y, Jan.-Feb. 1981, at 16.

37. Over the years, NYSE took aggressive steps to stave off competition amongst its members. For instance, in response to declining trading volumes during the late 1930s, NYSE adopted a rule prohibiting its members from trading in its securities on another exchange. The SEC later issued an order eliminating this rule, maintaining at least some minimal level of price competition with regional exchanges. *See* Robert L.D. Colby & Eric R. Sirri, *Consolidation and Competition in the US Equity Markets*, 5 CAPITAL MKTS. L. J. 169, 180-81 (2010) (citing In re *Rules of the NYSE*, 10 SEC 270, 272-73 (1941)).

38. *Market Turmoil; Averting Blizzard of Paper*, N.Y. TIMES (Oct. 25, 1987), http://www.nytimes.com/1987/10/25/us/market-turmoil-averting-blizzard-of-paper.html.

after every trade.[39] In the resulting chaos, traders piled documents "halfway to the ceiling,"[40] and "stock was found everywhere from the women's bathroom to the trash bins."[41] Not surprisingly, stock certificates were often misplaced, resulting in failed orders and lost shares.[42] Eventually, these logistical problems forced traders to end their trading early just to catch up on paperwork.[43]

Second, institutions became the largest owners of equities in the United States and began seeking ways to avoid paying NYSE's high fixed commission rates.[44] To meet this demand, "third-market" firms started conducting off-exchange block trades in NYSE securities at discounted commissions.[45] In 1969, Instinet established the world's first electronic market trading platform, allowing brokers to post offers to buy and sell stocks off-exchange and after regular market hours.[46] And in 1971, the National Association of Securities Dealers Automated Quotation Stock Market (NASDAQ) opened as the world's first electronic exchange. Unlike the NYSE's floor-trading specialist model, NASDAQ utilized an electronic quotation system and enlisted institutional market makers to compete openly against one another away from a physical trading floor.[47]

The SEC noted these developments with apprehension. An estimated $4 billion worth of securities had been lost in the NYSE's paperwork turmoil.[48] Ironically, many firms went out of business after they lost too many shares, overburdened by the weight of their own success.[49] While the SEC acknowledged the benefits of price competition from regional and over-the-counter (OTC) markets, increasing market fragmentation meant that most investors lacked effective access to quote information on

39. David C. Donald, *Heart of Darkness: The Problem at the Core of the U.S. Proxy System and its Solution*, 6 VA. L. & BUS. REV. 41, 50 (2011).

40. Joel Seligman, *Cautious Evolution or Perennial Irresolution: Stock Market Self-Regulation During the First Seventy Years of the Securities and Exchange Commission*, 59 Bus. Law. 1347, 1366 (2004).

41. *Market Turmoil*, *supra* note 38.

42. U.S. SEC. & EXCH. COMM'N, STUDY OF UNSAFE AND UNSOUND PRACTICES OF BROKERS AND DEALERS, H.R. DOC. NO. 92-231, at 13-14 (1971).

43. *Id.* at 28 ("The 'Paper Crunch' became so severe that the exchanges reduced trading hours and even closed one day per week in an effort to resolve these problems."); Donald, *supra* note 39, at 52; Seligman, *supra* note 40, at 1366.

44. U.S. SEC. & EXCH. COMM'N, INSTITUTIONAL INVESTOR STUDY REPORT, H.R. DOC. NO. 92-64, at IX, XXII (1971).

45. Eric Zitzewitz, *Retail Securities Regulation in the Aftermath of the Bubble*, in ECONOMIC REGULATION AND ITS REFORM: WHAT HAVE WE LEARNED? 576 (Nancy L. Rose ed., 2014).

46. *See* PATTERSON, *supra* note 8, at 109-11.

47. *See* Jerry W. Markham & Daniel J. Harty, *For Whom the Bell Tolls: The Demise of Exchange Trading Floors and the Growth of ECNs*, 33 IOWA J. CORP. L. 865, 899 (2008).

48. STUDY OF UNSAFE AND UNSOUND PRACTICES, *supra* note 42, at 7.

49. Seligman, *supra* note 40, at 1366, 1376 (stating between 1969 to 1970, approximately 160 firms went out of business "by having too much business") (internal citations omitted).

emerging trading platforms.[50] As a result, quotes across the market for the same security varied considerably.[51]

Ultimately, the SEC decided to investigate ways it could stimulate competition while also ensuring investors had access to information from all markets. After reviewing the situation, the SEC concluded that a drastic restructuring of markets was necessary. In its 1971 Institutional Investor Study, the SEC recommended to Congress that it "creat[e] of a strong central market system for securities of national importance, in which all buying and selling interest in these securities could participate and be represented under a competitive regime."[52] The next year, the SEC again advocated for "[a] system of communications by which the various elements of the marketplace, be they exchanges or over-the-counter markets, are tied together."[53] The SEC soon after issued a detailed policy statement describing how its proposed consolidated transaction system would work. In it, the agency called for the market-wide disclosure of price quotations by exchanges via electronic data feeds.[54] The policy went on to propose an "auction trading rule" that would give price priority protections for all public orders entered into a proposed central electronic repository and a "public preference rule" where public orders entering the repository would have preferential treatment over orders by professionals acting in a principal capacity.[55]

The SEC's efforts culminated in 1975 when Congress amended the Securities Exchange Act of 1934.[56] The amendments, among other things, banned fixed commissions,[57] thus instilling intra-exchange competition on NYSE, and authorized the SEC to develop a national market system akin to the one proposed in its 1973 Policy Statement.[58] The House Report noted that markets were "stunted and distorted" by various practices that "unnecessarily erected barriers to competition [and] insulated markets."[59] Decrying exchanges' outmoded technological setups, the House Report

50. *See, e.g.*, William J. Casey, Chairman, Sec. & Exch. Comm'n, The Changing Environment for Private Pension Plans, Address at the American Pension Conference (Oct. 7, 1971) ("There has been an erosion of the central market. Institutional trading, as it increased in volume, has drifted to the regional and [OTC] markets and to the third market . . . If you like this, you call it competition. If you don't, you call it fragmentation.").

51. *See* INSTITUTIONAL INVESTOR STUDY REPORT, *supra* note 44, at XXI.

52. *Id.* at XXIV.

53. Policy Statement on the Future Structure of Securities Markets, 37 Fed. Reg. 5286, 5287 (Mar. 14, 1972) (to be codified at 17 C.F.R. pt. 241).

54. U.S. SEC. & EXCH. COMM'N, POLICY STATEMENT ON THE STRUCTURE OF A CENTRAL MARKET SYSTEM 8 (Mar. 29, 1972).

55. *Id.*

56. Securities Acts Amendments of 1975, Pub. L. No. 94-29, 89 Stat. 97 (codified as amended in scattered sections of 15 U.S.C.) (amending the Securities Exchange Act of 1934, 15 U.S.C. §§ 78a-78pp (2012)) .

57. 15 U.S.C. § 78f(e)(1) (2012).

58. 15 U.S.C. § 78k-1 (2012).

59. H.R. REP. NO. 94-123, at 49 (1975).

acknowledged a need to correct past practices that had led to "misallocations of capital, widespread inefficiencies, and potentially harmful fragmentation."[60] The Senate Report similarly felt that "new legislation [was] necessary in order to assure investors . . . that our securities markets [remain] vigorous and efficient."[61] The Senate believed "many types of market makers [were] necessary and that encouragement should be given to all dealers to make simultaneous competing markets within the new national system."[62]

NYSE, for its part, begrudgingly accepted the new electronic paradigm. In 1976, the exchange introduced its "designated order turnaround" system (DOT), which delivered orders to trading posts electronically, although physical stock trading still took place on the exchange floor.[63] And in 1978, the SEC approved the NYSE-proposed Intermarket Trading System (ITS) plan that routed orders between various exchange floors.[64] Critically, the ITS plan also included a rudimentary "trade-through" rule prohibiting a participant from trading at an inferior price to that quoted on another participant market without first routing an order to the better market and giving it a minute to respond.[65]

By the 1990s, both NYSE and NASDAQ faced new sources of competitive pressure from novel trading venues called electronic trading communications networks (ECNs). ECNs were computer systems that facilitated trading outside of traditional exchanges or markets.[66] Traders liked ECNs because they provided another source of liquidity, allowed investors to trade after-hours, and generally reduced their costs.[67] The SEC recognized that ECNs acted like markets but did not want to force them to register as exchanges and risk stifling innovation and price competition. Thus, the SEC passed Regulation Alternative Trading System (Reg. ATS) in 1999, subjecting these platforms to certain operating and disclosure requirements, but ones less stringent than those imposed on exchanges.[68] Al-

60. *Id.*

61. S. Rep. No. 94-75, at 12, 14 (1975).

62. *Id.*

63. Frank J. Jones & Frank J. Fabozzi, *The U.S. Equity Markets*, *in* 1 HANDBOOK OF FINANCE, FINANCIAL MARKETS AND INSTRUMENTS 125, 131 (Frank J. Fabozzi eds., 2008).

64. Order Approving NYSE et. al Plan for Intermarket Communications Linkage, Exchange Act Release No. 14661, 14 Fed. Reg. 17,419 (April 14, 1978); *see also* In the Matter of Amex et al., Exchange Act Release No. 15058, 1978 WL 195796 (Aug. 11, 1978) (extending ITS plan participation approval order to other exchanges).

65. *Id.*

66. *See infra* Part I(B)(2).

67. Michael J. McGowan, *The Rise of Computerized High Frequency Trading: Use and Controversy*, 16 DUKE L. & TECH. REV. 1, 6 (2010).

68. Regulation of Exchanges and Alternative Trading Systems, 63 Fed. Reg. 70,844 (Dec. 22, 1998) (codified at 17 C.F.R. §§ 242.300-303 (2016)); *see also* Liz Moyer & Emily Lambert, *Wall Street's New Masters*, FORBES, Sept. 21, 2009, at 40-46, *available at* http://www.forbes.com/forbes/2009/0921/revolutionaries-stocks-getco-new-masters-of-wall-street.html. In 2015, the SEC proposed amendments to Reg. ATS that would dramatically increase the

gorithmic traders, and later high frequency traders, flourished. Spurred by Reg. ATS and the decimalization of stock prices, algorithmic traders began trading more often and in smaller increments, achieving better overall average prices on their large trades.[69]

The SEC embraced algorithmic trading with enthusiasm, as several exchange-related scandals cast doubt on the integrity of traditional market maker system. The "Odd-Eighths" controversy, for instance, developed after two finance professors discovered that NASDAQ dealers were collusively maintaining artificially wide bid-ask spreads on NASDAQ stocks.[70] By only quoting at certain intervals but not others, these market makers increased the amount they kept as profit on each purchase or sale. In response, regulators passed the Order Handling Rules, which required all brokers to post quotes from competing firms alongside quotes from market makers on the national system, including those from algorithmic traders.[71] The rules sent a clear message: algorithmic traders could be an effective source of competition for market makers and could instill more discipline in the overall market system.

The 1975 amendments' vision of was fully realized in 2005 once the SEC approved Regulation NMS (Reg. NMS).[72] Aimed at creating and enhancing competition on and between market centers for order flow, Reg. NMS established an electronic network between all national, or "protected," markets.[73] Reg. NMS included a trade-through prohibition similar to the one enacted in 1978, but now only with respect to automated, as

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regulatory burdens associated with operating an ATS. If adopted, these trading platforms would face extensive disclosure requirements and heightened oversight from the SEC with respect to the design and operations of an ATS. *See* Regulation of NMS Stock Alternative Trading Systems, 80 Fed. Reg. 80,998 (proposed Dec. 28, 2015). Regardless of the new amendments, these trading platforms remain an integral part of the modern marketplace: the system has adapted to them, not the other way around.

69. Before decimalization, stock markets operated on a fractional pricing system. For example, exchanges would quote a stock price in fractions (e.g., $10 1/8) as opposed to decimals (e.g., $10.12). The SEC expressed a concern that fractional pricing caused artificially wide spreads and hindered quote competition. The Commission ordered the exchanges and NASDAQ to implement decimal pricing in 2000, and fully implemented the system in April 2001. U.S. SEC. & EXCH. COMM'N, COMMISSION NOTICE: DECIMALS IMPLEMENTATION PLAN FOR THE EQUITIES AND OPTIONS MARKETS (July 24, 2000), http://www.sec.gov/rules/other/decimalp.htm.

70. *See, e.g.*, *In re* NASDAQ Market-Makers Antitrust Litig., 169 F.R.D. 493 (S.D.N.Y. 1996); Report Pursuant to Section 21(a) of the Exchange Act Regarding the NASD and the NASDAQ Market, Exchange Act Release No. 37542, 52 S.E.C. 882 (Aug. 8, 1996).

71. Order Execution Obligations, Exchange Act Release No. 34-37619A, 61 Fed. Reg. 48290 (Sept. 12, 1996); *see also* Thomas H. McInish, *The Effect of the SEC's Order-Handling Rules on NASDAQ*, J. FIN. RESEARCH (Sept. 22, 1998). Since NASDAQ market makers routinely dealt with ECNs in private transactions, the rules effectively mandated that NASDAQ display quotes from ECNs, thereby increasing price competition.

72. Regulation NMS, Exchange Act Release No. 51808, 70 Fed. Reg. 37,496 (June 29, 2005) (adopting release) (codified at 17 C.F.R. §§ 600-613 (2016)).

73. *Id.*

opposed to manual, quotes.[74] Thus, algorithmic traders were essential to Reg. NMS' regulatory design: regulators depended on these traders to submit competing quotes to exchanges across the country. In their mind, these traders would help consolidate order flow, reduce trading and execution costs, and increase market liquidity.[75] Despite its laudatory goals, Reg. NMS also substantially increased market complexity, as shown in the next section.

B. *How Modern Securities Markets Work*

Three major types of trading venues exist in the United States: registered exchanges, Electronic Communication Networks (ECNs), and Dark Pools. All three types must operate in accordance with Reg. NMS.[76] From a business perspective, a trading platform's profitability largely depends on its ability to attract customer order flow—the more transactions that take place, the more transaction fees they can collect. Advances in telecommunications technology and increasing globalization of capital markets have intensified competition among trading venues for these customers.[77] Consequently, many trading venues view HFT firms as business targets, adjusting their services accordingly.

1. Registered Exchange Trading

As stated, Reg. NMS governs modern exchange-based trading. For current purposes, Rules 603 and 611 are its two most important provisions. Under Rule 603, exchanges must send their best-priced quotations and trade reports detailing the price and size of their latest executed transactions to consolidated data feeds.[78] The data feeds consolidate the data and disseminate it to the public. Put another way, Rule 603 creates a single, national order book that combines all the best quotes across exchanges.

To make this national order book operable, Rule 611 requires that sell orders—regardless of the trading venue to which it was originally sent—execute at a price equal to the national best bid (NBB), or highest available price a buyer is willing to pay, across all registered exchanges.[79] Similarly, a buy order must execute at the national best offer (NBO), or lowest

74. Regulation NMS Rule 611, 17 C.F.R. § 242.611 (2016).

75. Paul S. Atkins, Commissioner, Sec. & Exch. Comm'n, Enhancement and Modernization of the National Market System (April 2005), https://www.sec.gov/news/speech/spch040605psa.htm.

76. Concept Release on Equity Market Structure, Exchange Act Release No. 34-61,358, 75 Fed. Reg. 3594, 3606 (Jan. 21, 2010).

77. Ian Russell and Edward Waitzer, *Should Exchanges Retain Regulatory Role in a New Age?*, FIN. POST (March 1, 2012), http://business.financialpost.com/fp-comment/role-exchange.

78. 17 C.F.R. § 242.603 (2016).

79. *See* 17 C.F.R. §§ 242.611(a)(1), 242.600(b) (2016) (defining relevant terms).

available price a seller is willing to accept. When this does not happen, a "trade-through" occurs.[80]

Most markets are set up as electronic limit order books. In these order books, traders provide liquidity by submitting limit orders to buy or sell specific quantities of stock at a specified price, or remove liquidity by sending market orders to buy or sell at the best available prices.[81] When a market order arrives, the exchange matches it against a resting limit order. The exchange first prioritizes these orders by price and then, within each price level, by their time of arrival.

For example, imagine John wants to buy 1000 shares of IBM and submits a market order. Gathering all resting limit orders in IBM from all registered exchanges, the Rule 603 order book appears as follows:

BIDS		OFFERS	
PRICE	SHARES	PRICE	SHARES
$40.41	NYSE 200 NASDAQ 200 BATS100	$40.42	NYSE 300 NASDAQ 200 BATS100
$40.39	NYSE 200 NASDAQ 100	$40.44	NYSE 300
$40.37	NYSE 300	$40.45	NASDAQ 600
$40.36	NASDAQ 200	$40.46	NASDAQ 200

Here, the NBB is $40.41 for a total of 500 shares and the NBO is $40.42 for a total of 600 shares. Let us assume John submits his order to the NYSE. His order would initially execute for 300 shares at $40.42. Under Rule 611, NYSE would then forward orders for 200 shares to NASDAQ and 100 shares to BATS since shares are available on those exchanges at $40.42. These orders would then execute on those venues at this price. Afterward, NYSE would execute 300 shares at the next price level, $40.44, and forward another order to NASDAQ for the remaining 100 shares at the third price level, $40.45. John's average price would thus be $40.426.

Data latency, however, creates complications. It takes time for quote and execution data submitted by an exchange to reach the consolidated data feed. Thus, quote changes on the national reporting system can lag slightly behind the actual activities on a given exchange. Under Rule

80. Rule 611(a)(1) specifically requires a "trading center" to implement policies and procedures that are reasonably designed to prevent these trade-throughs unless such trades fall within one of the exceptions set forth in paragraph (b) of the Rule. 17 C.F.R. § 242.611(a)(1) (2016).

81. Market orders are unconditional orders to buy or sell a security at the best price currently available. Limit orders, in contrast, are conditional orders to buy or sell a security at a given price or better. For example, an investor could submit an order to buy 100 shares of IBM so long as the price at which they buy is $40 or less. Once the market price reaches $40, the limit order becomes "marketable" and acts like a market order.

603(a), however, exchanges can distribute customized market data products directly to customers.[82] HFT firms can, by purchasing these products and co-locating their servers close to exchange processing systems, get notice of changes in bids, offers, or executions slightly before the consolidated data feed publically disseminates the information.[83] Given their technological sophistication, HFT firms act on this information before someone like John could even see, let alone react, to it.

2. Off-Exchange Trading

ECNs are automated systems that match buyers and sellers directly rather than going through a registered exchange. ECNs, like exchanges, must abide by Rule 611. For instance, in the example from the previous section, let's say John actually wants to buy 10,000 shares of IBM and is willing, given the large size of the order, to execute his trade at $40.52–a price worse than all other quotes currently in the order book. If John is trading on an ECN, the ECN would route limit orders to NYSE, NASDAQ, and BATS to buy at $40.50 or better, which would then execute all 1,700 shares quoted for sale on the exchanges with better prices. The remaining 8,300 shares could then execute against contra-side orders in the ECN at $40.52, bringing John's average price to $40.505.

Dark pools are similar to ECNs except they do not send their best-priced orders for inclusion in the consolidated data feed (thus the "dark" moniker). Dark pools originally drew large institutional investors because of this quote opacity: they could trade large stock positions anonymously, minimizing possible price movements against their trading interests.[84] Current dark pools, however, vary with respect to both who their customers are and what services they offer. Some dark pools, like block crossing networks, offer specialized size discovery mechanisms that focus on bringing large buyers and sellers together.[85] These dark pools are extremely discerning in whom they allow into their systems. Most dark pools, however, primarily execute trades with small sizes comparable to public markets.[86] These dark pools generally match smaller "child" orders that are part of larger "parent" orders and are less discerning as to whom they allow into the pool.[87]

HFT firms like ECNs and dark pools because they often achieve swifter trade execution and lower transaction costs as compared to many exchanges. Specifically with respect to dark pools, HFT firms like their

82. *See* 17 C.F.R. §242.603(a) (2016).

83. Gary Stone, *SIP vs. Direct Feeds Latency - What are the Rules?*, BLOOMBERG TRADEBOOK (May 15, 2014), https://www.bloombergtradebook.com/blog/sip-vs-direct-feeds-latency-rules/; Nanex*, Direct vs. SIP Data Feed*, (Apr. 4, 2014), http://www.nanex.net/aqck2/4599.html.

84. Concept Release on Equity Market Structure, *supra* note 76, at 3599.

85. *Id.*

86. *Id.*

87. *Id.*

lower fees and pre-trade anonymity. These features put them in better positions to detect large institutional orders and trade against them.[88]

C. *Commonly Employed High Frequency Strategies*

Although many HFT strategies share common characteristics, HFT has no official definition.[89] Since many of these strategies have different goals and disparate market effects, this is not surprising. As the International Organization of Securities Commissions (IOSCO) recently pointed out, "determining a precise definition may not even be practical for regulatory purposes as it could easily become obsolete or the object of regulatory arbitrage."[90]

Nonetheless, "regulators can find it difficult to draw the line between acceptable trading strategies and manipulation because of the complexity of the strategies."[91] This section clarifies these difficulties by identifying the four most common types of HFT strategies. Experts often label the first strategy, market making, as a *passive* strategy and the latter three as *aggressive* strategies.[92] Passive strategies generally involve injecting liquidity into the secondary market, i.e., where HFT actively posts non-marketa-

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88. New York Attorney General Eric Schneiderman filed a civil suit against one of the largest dark pool operators, Barclays, under New York State law. A central allegation was that Barclays misrepresented the level of aggressive HFT activity in its dark pool. Complaint, Schneiderman v. Barclays Capital Inc., No. 4511391/2014 (N.Y. Sup. Ct. July 24, 2014). One industry observer noted that "[t]he problem [wasn't] that high-frequency trading firms [were] participating in dark pools. . . . the troubling . . . allegation [was] that the broker lied to clients about the presence of a big HFT firm." *See* Nicole Bullock, *Momentum Builds for Dark Pool Reform*, FIN. TIMES (June 26, 2014), www.ft.com/intl/cms/s/0/6ec5f93efd47-11e3-96a9-00144feab7de.html.

89. For its part, the SEC offered a characteristics-based description of HFT in 2010:

> "[HFT] typically is used to refer to professional traders acting in a proprietary capacity that engage in strategies that generate a large number of trades on a daily basis . . . [o]ther characteristics [include] (1) the use of extraordinarily high-speed and sophisticated computer programs for generating, routing, and executing orders; (2) use of co-location services and individual data feeds offered by exchanges and others to minimize network and other types of latencies; (3) very short time-frames for establishing and liquidating positions; (4) the submission of numerous orders that are cancelled shortly after submission; and (5) ending the trading day in as close to a flat position as possible."

Concept Release on Equity Market Structure, *supra* note 76, at 3606.

90. TECHNICAL COMM., IOSCO, REGULATORY ISSUES RAISED BY THE IMPACT OF TECHNOLOGICAL CHANGES ON MARKET INTEGRITY AND EFFICIENCY 21 (2011).

91. Peter J. Henning, *Why High-Frequency Trading Is So Hard to Regulate*, N.Y. TIMES (Oct. 20, 2014), http://dealbook.nytimes.com/2014/10/20/why-high-frequency-trading-is-so-hard-to-regulate/?_r=0.

92. Matthew Baron, Jonathan Brogaard & Andrei Kirilenko, Risk and Return in High Frequency Trading, 4-5 (unpublished manuscript), (April 2014) (on file with CFTC), http://www.cftc.gov/idc/groups/public/@economicanalysis/documents/file/oce_riskandreturn0414.pdf (noting "Aggressive HFTs earn substantially higher returns than Passive HFTs . . . suggesting that there is a stronger profit motive for liquidity taking compared to liquidity provision"); GARY SHORTER & RENA S. MILLER, CONG. RESEARCH SERV., R44443, HIGH-FREQUENCY TRADING: OVERVIEW OF RECENT DEVELOPMENTS 2-6 (2016), https://www.fas.org/sgp/crs/misc/R44443.pdf.

ble limit orders.[93] Aggressive strategies, in contrast, involve taking liquidity out of the market, i.e., sending orders into the secondary market that are immediately executable.[94]

1. Market-Making Strategies

Market-making strategies inject liquidity into the market by regularly offering to buy or sell a security and then pocketing the difference between the bid and ask prices. These strategies also profit from liquidity-provision rebates offered by trading venues under the "maker-taker" system. In the past, many exchanges charged a small access fee to both buyers and sellers.[95] Now, most exchanges have raised their access fee, collecting the full fee to those traders who "take" liquidity by submitting market orders that execute against resting limit orders, and rebating all or a portion of the fee back to those traders that "make liquidity" by submitting standing limit orders.[96] Although only amounting to fractions of a cent per share, the cumulative value of these rebates can be substantial.

A market-making strategy's success depends on how fast it can react to new information. As this information arrives, market makers incur adverse selection risk, or the risk of trading with better-informed market participants and losing money as a result. To mitigate this risk, HFT market makers expend significant resources to ensure they can consistently position their orders at the top of an order book, often canceling and replacing their resting limit orders in rapid fashion. This also explains why HFT market makers like specialized order types that allow them to maintain their position toward the front of the order book without directly canceling and replacing their orders.[97]

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93. *Id.*

94. *Id.*

95. *See, e.g.,* Stanislaw Dolgopolov, *The Maker-Taker Pricing Model and its Impact on the Securities Market Structure: A Can of Worms for Securities Fraud?*, 8 VA. L. & BUS. REV. 231, 270 (2014).

96. *See* Concept Release on Equity Market Structure, *supra* note 76, at 3598, 3599; *see also*, Dolgopolov, *supra* note 95 (discussing how variations in the maker-taker pricing model across exchanges contributes to growing market complexity).

97. One such specialized order type is the "Hide-Not-Slide" limit order. Imagine that the NBBO for IBM is again $40.41-$40.42 on NYSE. Further suppose that, for whatever strategic reason, an HFT market maker wants to put a standing buy order at 2:00 PM at $40.42 on the BATS exchange, and wait until someone hits it. Rule 611 prevents "locking" the market at NBBO $40.42-$40.42. If the order submitted to BATS was a regular limit order, the exchange would "slide" the price back to $40.41. But assume that one minute later the NBBO shifts to $40.42-$40.43. BATS would "slide" the regular limit order price back up to $40.42 and give it a time-stamp of 2:01 PM. A Hide-Not-Slide limit order works similarly, except that the order would retain a 2:00 PM time-stamp, thus giving that order time-based priority in the order book. *See generally,* In the Matter of *EDGA Exchange*, Exch. Act. Rel. No. 74032 (Jan. 12, 2015) (sanctioning Direct Edge for selectively disclosing information about how Hide-Not-Slide orders operated to its members).

HFT market makers often claim their actions are positive because they act as liquidity providers, reducing bid-ask spreads and market volatility levels. The article discusses these claims in more depth in Part II.B.

2. Arbitrage Strategies

Arbitrage strategies take advantage of price discrepancies between identical or related securities on different markets. *Statistical arbitrage* strategies have always been a common practice and are relatively straightforward: traders try to exploit price differentials between correlated securities across markets. If two securities exhibit consistent trading patterns, statistical arbitrageurs will assess whether an observed divergence is only temporary. If so, then the statistical arbitrageur will trade against the temporary price change and capture the pricing difference once the security reverts to its historical relationship.[98]

Structural arbitrage strategies are a more recent phenomenon. Sometimes called *latency arbitrage*, a simplified example best explains how these strategies work. Revisiting John's quest to buy IBM stock, assume the NBB and NBO remain $40.41 and $40.42, respectively. Next, assume that the NYSE receives a buy order for 300 shares at $40.42 that executes. At the same time, a new limit order boosts the NYSE's best bid to $40.43, meaning its best bid-ask quote is now actually $40.43-$40.44. HFT firms, with their fast connection speeds and sophisticated algorithms, will quickly perceive and react to this new order. They will buy all the shares on NASDAQ and BATS at $40.42 and immediately sell them on NYSE for $40.43. Traders quickly exploit these price differentials, which usually only last for fractions of a second.[99] Estimates calculate that trading on these advantages accounts for upwards of $21 billion in profit per year,[100] although competition has reduced that number significantly.[101]

Statistical arbitrage is relatively uncontroversial sinceit fights pricing discrepancies, facilitates price discovery, and improves market efficiency. Commentators, however, have criticized latency arbitrage as having only a mixed effect on market liquidity and market efficiency,[102] while spurring unnecessary and socially undesirable investment in faster connectivity and order processing technology.[103]

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98. *See generally,* Brogaard et al., *supra* note 14, at 2268, 2269.

99. Diego Leis, High Frequency Trading: Market Manipulation and Systemic Risks from an EU Perspective 22-25 (Feb. 29, 2012) (unpublished manuscript), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2108344.

100. Matt Prewitt, *High-Frequency Trading: Should Regulators Do More*, 19 MICH. TELECOMM. & TECH. L. REV. 131 (2012).

101. *Id.*

102. *Id.*

103. Larry Harris, *Stop the High-Frequency Trader Arms Race*, FIN. TIMES (Dec. 27, 2012), http://www.ft.com/cms/s/0/618c60de-4b80-11e288b500144feab49a.html#axzz42bH3x6JS.

3. Directional/Predatory Strategies

Directional strategies look to profit from anticipated securities price movements. One type of directional strategy called *momentum ignition* consists of entering orders or a series of orders, perhaps combined with spreading false rumors in the marketplace, to get other market participants to trade. These orders ignite rapid price movements up or down. Another type of directional strategy, called *spoofing* or *layering*, involves submitting a series of orders also intended to induce a rapid directional price movement. If successful, the HFT firm will establish an early position in the security, profiting when the price of the security moves in the desired direction and the firm liquidates its position.[104]

A related third strategy, called *quote stuffing*, places many orders and then cancels them almost immediately.[105] These strategies aim to slow down the market, giving the HFT firm a speed advantage. The sheer number of orders slows down the national limit order book, creating an artificial arbitrage opportunity.[106] The HFT firm's position also gains a functional speed boost relative to other HFT firms that need to sort through and analyze all the fake quotes.[107] In some egregious cases, an HFT firm may try to quote-stuff an entire exchange to have more time to capitalize on cross-exchange price differences.[108]

These strategies are all heavily criticized for their rapid trading, short holding periods, and generally non-beneficial effects on market liquidity or price discovery. The difficulty, from a practical standpoint, is distinguishing manipulative patterns from legitimate ones when the volume and frequency of trading is so high.

4. Liquidity Detection Strategies

Liquidity detection strategies try to find and trade against large institutional orders. HFT firms will repeatedly submit small-sized orders intended to detect large orders from institutional investors. Based on intelligence gathered from this process, these strategies can then trade ahead of large orders under the assumption that the large order will move the market's pricing of the security to their benefit.

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104. *See* SHORTER, *supra* note 92, at 4.

105. Adam Adler, *High Frequency Regulation: A New Model for Market Monitoring*, 39 VM. L. REV. 161, 172-73 (2014).

106. *Id.*

107. *Id.*

108. The CFTC and Department of Justice charged an HFT firm for violations involving quote stuffing. First, the firm's algorithm would test the market by "pinging" orders. Then the algorithm would place several layers of orders on the opposite side of the market from the targeted trade—typically near, but not at, the prevailing market price—to create the illusion of market interest that would then move futures contracts toward the targeted price. In the Matter of *Panther Energy Trading, LLC et al.*, CFTC Docket No. 13-26 (July 22, 2013) United States v. Coscia, 100 F. Supp. 3d 653 (N.D. Ill.) (2015).

One particularly contentious application of the strategy involves "flash orders." The term refers to unmatched orders that an exchange "flashes" to participating traders at the NBBO price for a brief period, usually between 30 and 500 milliseconds, and who then can choose whether they want to trade against the orders before they are routed.[109] Some traders and industry observers believe flash orders should constitute a form of illegal front-running,[110] and the SEC has expressed concerns that "flash orders may create a two-tiered market in which the public does not have access, through the consolidated quotation data streams, to information about the best available prices for listed securities."[111] Others counter that these traders are only trading on public information and thus should remain legal.[112]

D. *High Frequency Trading in Global Markets*

HFT is not a U.S.-specific phenomenon. With their sophisticated order processing and communications systems, HFT firms can trade in almost any market across the globe. Driven by competitive and technological pressure from off-exchange trading platforms, many exchanges converted from quasi-public entities to for-profit companies. This process, known as demutualization, allowed exchanges to merge with domestic and foreign counterparts to get more companies to list securities on their exchanges, increase order flow, and generate more transaction fees.[113]

At the same time, trading in cross-listed securities has increased. Many jurisdictions and exchanges allow companies to list their securities on exchanges in multiple countries so long as the issuer meets certain listing standards and adheres to each country's relevant regulations. In the United States, the most common way of doing so is through American Depository Receipts (ADRs).[114] Simply put, U.S. banks buy foreign

109. Lawrence Harris & Ethan Namvar, The Economics of Flash Orders and Trading 4 (Jan. 15, 2011) (unpublished manuscript) (on file with the Medoza College of Business, University of Notre Dame), http://business.nd.edu/uploadedFiles/Academic_Centers/Study_of_Financial_Regulation/pdf_and_documents/SSRN-id1953524.pdf.

110. *See generally*, MICHAEL LEWIS, FLASH BOYS: A WALL STREET REVOLT (2014); *see also* Yesha Yadav, *How Algorithmic Trading Undermines Efficiency in Capital Markets*, 68 VAND. L. REV. 1607, 1666 n.207 (citing FINRA Rule 5720) (explaining the difference between illegal front-running and electronic front-running).

111. *See* Elimination of Flash Order Exception from Rule 602 of Regulation NMS, 74 Fed. Reg. 48,632, 48,636 (proposed Sept. 23, 2009).

112. Committee on Capital Markets Regulation, *What is High Frequency Trading?* 8 (Dec. 12, 2014).

113. *E.g.*, Nina Mehta and Nandini Sukumar, *Intercontinental Exchange to Acquire NYSE for $8.2 Billion*, BLOOMBERG (Dec. 20, 2012), http://www.bloomberg.com/news /articles/2012-12-20/intercontinentalexchange-said-in-merger-talks-with-nyse-euronext.

114. *See* Brendan M. Daniels, *The Phantasmal Presence: American Depository Receipts and Personal Jurisdiction*, 9 FED. CTS. L. REV. 1, 2 n.5 (2016) ("There are over 2,000 ADRs in American markets. Since 2003 to 2013, it is estimated that the number of shares of ADRs traded totaled around 146 billion with a value of $3.5 trillion dollars.") (internal citations omitted).

shares in bulk from a foreign company, bundle them into groups, and then reissue them as negotiable interests on a U.S. exchange. ADRs and their foreign analogs offer HFT firms arbitrage opportunities. Cross-listed stock prices on a foreign exchange might diverge from the home exchange price for a variety of technical reasons.[115] Exchange price ADRs, for instance, in U.S. dollars will usually differ from the home market price due to exchange rates.[116] Because the strategy is so simple, these opportunities disappear quickly.[117] These reasons incentivize HFT firms to continue investing substantial resources toward bolstering the speed and adaptability of their trading systems.

Issuers, investors, and exchanges have flocked to cross-listed securities. As of January 2016, NYSE lists 513 foreign companies from 46 different countries, with trading in those securities accounting for approximately 17% of total volume.[118] HFT firms have shown a particular propensity to target these securities, with one study finding that HFT participation at the start of U.S. trading was 10% greater in cross-listed than non-cross-listed stocks.[119] Consequently, many exchanges now have extended hours to account for trading in cross-listed securities.[120]

II. Establishing an Evaluative Framework

A. *Guiding Principles*

Now that the reader has a basic understanding of the history and structure of secondary markets, we can establish guiding principles regulators can consider as they grapple with HFT-related issues. In doing so, it is important to consider, as an initial matter, why secondary markets exist to begin with and what functions they perform.

Secondary markets are essential tools for promoting economic growth, namely by pricing and re-pricing new assets quickly, accurately, and fairly.[121] Secondary markets lower transaction costs by establishing a forum where investors can trade their securities on-demand. Thus, established secondary markets should induce investors to make more trades,

115. *See, e.g.*, Minho Kim, Andrew C. Szakmary, and Ike Mathur, *Price Transmission Dynamics between ADRs and their Underlying Foreign Securities*, 24 J. Banking & Fin. 1359 (2000) (examining the dynamic between ADRs and their underlying securities using three pricing factors: the price of the underlying share in the local currency, the relevant exchange rate, and the U.S. market index).

116. *Id.*

117. *See* James J. Angel and Douglas McCabe, *Fairness in Financial Markets: The Case of High Frequency Trading*, 112 J. Bus. Ethics 585 (2013) (stating that

118. Daily NYSE Group Volume in NYSE Listed 2016, NYSE (Feb. 29, 2016), http://www.nyxdata.com/nysedata/asp/factbook/viewer_edition.asp?mode=table&key=3141&category=3.

119. *See* Alampieski, *supra* note 29.

120. *See Overview of Major World Exchanges' Trading Hours*, HKEx Monthly Newsletter (H.K. Exchs. & Clearing Ltd., H.K.) July 2011, at 36-42.

121. *See* Fox et al., *supra* note 31, at 222-225.

thereby generating prices that are more accurate. In turn, more accurate stock prices should lower issuers' costs of capital since investors, assured that they can resell their investments at these prices, will demand lower rates of return.[122] Consequently, investors can readily determine the value of their investments and creditors to evaluate the creditworthiness of their borrowers.

Secondary markets also serve as important liquidity mechanisms.[123] Primary market investors are less willing to contribute capital if it is difficult to exit their positions in the future. Secondary markets alleviate this issue by reducing the costs that every investor would otherwise incur finding contra-parties to their later securities transactions. In this sense, liquidity promotes allocative efficiency: more liquidity makes it less costly to sell securities in the future, meaning investors demand a lower return when initially purchasing the securities.[124] Similarly, liquidity reduces volatility: the more available shares there are, the lower the risk that severe price swings will occur during periods of market stress. This is important because a security's price reflects the market's confidence in the issuer's management. Higher volatility, therefore, may indicate higher riskiness, possibly translating to higher costs of capital.[125]

Secondary markets also protect investors. Capital from investors encourages innovation, promotes competition, and spurs job creation throughout the economy. If assured markets will treat their later transactions fairly, investors will be more willing to make these contributions. Organized secondary markets help investors achieve this peace of mind through rules prohibiting fraudulent trading and banning manipulation of securities prices.[126] Other rules target other aspects of fairness, like requiring trade executions at fair prices, mandating market participants keep records of their activities, and demanding prompt dissemination of pricing information.[127]

Two major developments underscore investor protection's importance. First, more Americans are putting their personal wealth and retirement savings into securities. Between the mid-1970s and the late 1990s, the share of household financial assets held in bank deposits fell, while those held in mutual funds and securities jumped from 22% in 1975 to 42% in 1999.[128] Consequently, rising ownership rates expose more households to

122. *Id.*

123. *See* Hendershott, *supra* note 15.

124. LAWRENCE E. HARRIS, TRADING AND EXCHANGES 214-15 (2002).

125. *See* Fox, *supra* note 121.

126. *See, e.g.*, Securities Exchange Act §§ 9, 10(b), 18, 20 (1934); 15 U.S.C. § 87 (2012).

127. *See* Regulation NMS, *supra* note 24.

128. To a large extent, this shift stemmed from several financial innovations, like money market mutual funds and Individual Retirement Accounts, which opened up previously closed-off investing opportunities to Main Street America. *See* JOHN V. DUCA, FED. RES. BANK OF DALLAS, THE DEMOCRATIZATION OF AMERICA'S CAPITAL MARKETS 13-14 (2007), https://www.dallasfed.org/assets/documents/research/efr/2001/efr0102b.pdf.

large market swings. Second, while many recent technological innovations in markets have been pro-investor, they also created new risks.[129] As the nature of securities trading continues to change, we must assure investors that the market protects their interests.

HFT has advanced each of these functions. Research shows that some HFT strategies, such as market making and arbitrage, help detect pricing anomalies and therefore stabilize markets.[130] Other studies suggest that HFT has lowered transaction costs and increased certain measures of liquidity.[131] And with respect to investor protection, abuses akin to the Odd-Eighths controversy have all but disappeared.

But HFT also risks inhibiting these functions if not properly managed. Accordingly, regulatory responses should focus on how to harness HFT to improve these functions without sacrificing market integrity or stability. In doing so, HFT regulation should pursue three primary goals:

1. Promote the secondary market's performance of its key functions, recognizing that HFT is a broad and diverse category of trading that many historically thought benefitted secondary markets in key ways;
2. Foster confidence in the secondary market by protecting participants from emerging risks associated with HFT;
3. Minimize the chance that systemic, HFT-induced events interrupt the market's performance of these functions.

B. *Problematic Issues with High Frequency Trading*

Applying these principles, HFT raises important issues. While this article separates these concerns into four broad (and overlapping) categories, in a sense they are all indicative of a more general dissociative problem. Exchanges serve to promote business investment by assuring investors that they can always sell their shares at a published price. Today, however, the act of trading is increasingly becoming an end in itself, operating to separate itself from the goods-and-services producing part of the economy.[132] Officials worry that trading volume is "unrelated to the fundamentals of the company that's being traded."[133] As Professor Harris astutely points out, HFT trading profits persistently and disproportionally accumulate to a handful of HFT firms, creating what many consider a win-

129. See Div. of Trading & Mkts., U.S. Sec. & Exch. Comm'n, Equity Market Structure Literature Review, Part I: Market Fragmentation 7 (2013).

130. Office of Financial Research, U.S. Dep't of Treas., 2013 Annual Report 28-30, (2013), http://www/treasury.gov/initiatives/ofr/about/Documents/OFR_AnnualReport 2013_FINAL_12-17-2013_Accessible.pdf.

131. Div. of Trading & Mkts., U.S. Sec. & Exch. Comm'n, *supra* at note 6, at 27-28.

132. *See* Tor Brunzell, *High-Frequency Trading–To Regulate Or Not to Regulate–That Is the Question*, 2 J. Bus. & Fin. Aff. 1, 2 n.1 (2013) (noting that in October 2008, one HFT firm traded over 2 billion shares in a single day).

133. *See* David S. Hilzenrath, *High-Frequency Trading Raises Concerns at SEC*, Wash. Post (Feb. 22, 2012) https://www.washingtonpost.com/business/ economy/ high-frequency-trading-raises-concerns-at-sec/2012/02/22/gIQAfpLdTR_story.html.

ner-takes-all industry.[134] Decreasing competition means that trading costs and the average cost of capital will rise.[135] We must question whether the increasingly large sums spent by HFT firms to boost their trading speeds produce worthwhile social benefits.[136]

1. Price Accuracy and Allocative Efficiency Concerns

One worry is that HFT harms the secondary market's pricing function by trading based on short-term statistics unrelated to the fundamental value of a given security.[137] At the end of World War II, investors held a US stock, on average, for four years. In 2008, that average time had fallen to two months. By 2011 – 22 seconds.[138] These trading patterns, officials fear, obfuscate rather than clarify the financial health of the issuer in the eyes of investors.[139] Rather than contributing new information to stock prices, HFT might actually drive it further away from its fundamentals-based price (unlike long-term investors who analyze and trade based on the underlying value of the stock), ultimately impeding allocative efficiency.

Evidence provides mixed support for these claims. On an intraday basis, HFT arbitrage strategies, with their rapid execution speed, respond to news ahead of other investors and potentially make stock prices reflect new information more quickly.[140] HFT's long-term effect on price accuracy is less clear. Some studies suggest that HFT-initiated price movements often have more lasting, long-term effects than price movements initiated by non-HFT traders.[141] Other research, however, shows that HFT activity hampers price discovery by making markets "too efficient," causing stock prices to move excessively in the direction of fundamentals-related news and ultimately harming longer-term price discovery.[142]

These studies, however, do not distinguish between the many types of HFT strategies and their differing effects on price discovery. Market-making strategies, for instance, tend to benefit price discovery more than

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134. Harris, *supra* at 103.

135. *Id.*

136. In the HFT world, these sums are worth it: a one millisecond advantage in trading could be worth an extra $100 million in annual profit. PATTERSON, *supra* note 8, at 287-78.

137. Kirilenko et al., *supra* note 18.

138. Patterson, *supra* note 8, at 46.

139. *See, e.g.*, Hilzenrath, *supra* note 133.

140. *See* Concept Release on Equity Market Structure, *supra* note 76, at 3608 (stating HFT arbitrage activity "often may contribute to the quality of price discovery in a stock").

141. Brogaard et al., *supra* note 14, at 2277-80.

142. *See* X. Frank Zhang, High Frequency Trading, Stock Volatility, and Price Discovery 33-35 (2010) (unpublished manuscript), http://papers.ssrn.com/sol3/papers.cfm?abstractid=1691679.

other, more aggressive strategies.[143] And while arbitrage strategies trading a single security across multiple markets can help price discovery, other arbitrage strategies, like latency arbitrage, may instead be harmful.[144] Similarly, one study found that many HFT strategies tend to place buy (sell) market orders just before an increase (a decrease) in the market valuation of assets, suggesting HFT strategies that use market orders possess and act on fundamentals-related information.[145] In contrast, HFT firms buy (sell) limit orders tend to execute when market valuations are falling (increasing), suggesting that HFT strategies relying on limit orders are trading based on more speculative, non-fundamentals-related information. At least with respect to price discovery, these types of trading patterns are less socially beneficial.[146]

The better question, therefore, asks to what extent HFT firms use these latter parasitic strategies, since such trading could result in prolonged deviations from fundamental values and undermine conditions necessary for markets to generate and synthesize information.[147] Specifically, if HFT reduces information-based trading's profitability, traders have no incentive to generate it. Consequently, if large traders are unable to hide their trades from parasitic HFT strategies, this trading harms long-term market efficiency by repressing the market's information-generation function.[148]

2. Selective Liquidity and Volatility Concerns

While it is generally undisputed that HFT has contributed to narrower bid-ask spreads and lower transaction costs for many securities and investors,[149] evidence suggests that HFT-provided liquidity is often selective and fleeting. As an example, HFT firms may simply stop providing liquidity or suddenly engage in liquidity-taking trades, especially during periods of market stress.[150] Even if HFT remains in the market, HFT contributes deceptively little to the depth of shares available. Many HFT strategies submit quotes for relatively small amounts of shares, rapidly canceling and

143. *See* TECH. COMM. OF THE INT'L ORD. OF SEC. COMM'NS, REGULATORY ISSUES RAISED BY THE IMPACT OF TECHNOLOGICAL CHANGES ON MARKET INTEGRITY AND EFFICIENCY 26 (2011).

144. *See* Prewitt, *supra* note 100.

145. *See* Brogaard et al., *supra* note 14.

146. *See id*.

147. *See* Charles R. Korsmo, *High-Frequency Trading: A Regulatory Strategy*, 48 U. RICH. L. REV. 523, 573 (2014).

148. *Id.*; *see also* Daniel R. Fischel & David J. Ross, *Should the Law Prohibit "Manipulation" in Financial Markets?*, 105 HARV. L. REV. 503, 509-10 (1991) ("Traders must be allowed to disguise their trades to avoid disclosing the information they possess to other traders.").

149. *See, e.g.*, Hendershott et al., *supra* note 15, at 30-31.

150. *See* Dean, *supra* note 20, at 224-25 ("Voluntary market-makers [like HFT firms] can withdraw their capital from the market whenever they choose to do so, and history has shown that when the market takes a downturn, they often do.").

replacing them with new ones in order to adapt to changing market conditions and maintain favorable positions in order books.[151] When spreads were wider, average trade sizes used to be in the thousands. In 2015, the average trade size was only 160-180 shares.[152] Put another way, Rule 611 enables situations where HFT market makers may quote narrow spreads but remain unwilling to buy or sell sizeable quantities at those prices. HFT exacerbates these issues by displacing other kinds of liquidity suppliers, like traditional market makers, who might have been willing to effect larger transactions.[153]

Moreover, HFT-driven liquidity gains are generally limited to certain blue-chip stocks that already had relatively high liquidity levels.[154] HFT firms, like all traders, prefer securities with narrow spreads and heavy trading volumes since these characteristics reduce their own liquidity risk. However, while aggressive traders typically like to trade in securities with high volatilities (large price swings mean more profit opportunities), most HFT actually prefers *lower* volatility securities because their strategies depend on making small profits with near certainty. Similarly, while a typical trader might be indifferent to a security's price, the maker-taker rebate system incentivizes HFT firms to trade in lower-priced securities since rebates are based on the *number of shares traded*, not the *total amount traded*. In short, any liquidity gains are likely isolated to securities least in need of the boost. Empirical evidence supports these claims. One study found that while standard measures of market liquidity improved after the introduction of HFT strategies for stocks with large capitalizations, there was no significant effect on market liquidity for stocks with small capitalizations.[155] Another study, examining algorithmic more generally, similarly found that its beneficial effects on liquidity accrued mainly to stocks with large capitalizations and low volatility.[156] In contrast, algorithmic trading appeared to decrease liquidity for small cap stocks and not affect the liquidity of high-volatility stocks.[157]

On the other hand, it is unclear whether HFT-provided liquidity actually increases or decreases volatility. One study, looking at the foreign exchange market, found that despite high correlations among HFT strategies, no causal relationship existed between HFT trading and ex-

151. Gary Stone & Sanghyun Park, *As Odd-Lots Report to Tape, Average Trade Size Declines Again*, BLOOMBERG (Mar. 4, 2014), http://www.bloombergtradebook.com/blog / odd-lots-average-trade-size-declines-again/.

152. *Id.*

153. Because of their speed advantage, HFTs can supply liquidity on better terms than slower traders. This creates an adverse selection problem for slow liquidity suppliers, who can be crowded out of the market by HFTs. *See* Brogaard et al., *supra* note 14.

154. *See* Picardo, *supra* note 21.

155. *Id.*

156. Ekkehart Boehmer, Kingsley Fong, & Juan Wu, International Evidence on Algorithmic Trading (Sept. 17, 2015) (unpublished manuscript), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2022034.

157. *Id.*

change rate volatility.[158] In another study, researchers found HFT was in fact associated with higher levels of volatility. Analyzing the trading activity of thirteen NASDAQ stocks subject to a ban on short-selling for three weeks in September and October 2008, the study found that HFT-associated trading volume fell sharply for those stocks compared to unaffected stocks.[159] Generalizing the short-sale ban as a negative shock to HFT activity, the study concluded that stocks in which short-sales by HFT firms were most affected (relative to other stocks) experienced relatively greater increases in volatility, consistent with HFT's general negative effect on volatility overall.[160]

Even if we assume that HFT has generally reduced volatility at the individual security level, it likely increased volatility at the macro level.[161] One study found that higher trading volumes could destabilize market conditions and produce "volatility above and beyond that based on fundamentals."[162] Interestingly, the study also suggested that there was an inflection point at which an increase in trading volume increases volatility such that only a small circle of investors benefit.[163] Instead, overall benefits to investors "dominate at low to medium levels of trading."[164] In a similar vein, Andrew Haldane recently pointed to the danger of normalizing deviance at the micro level, concluding that "thinner technological slices may make for fatter market tails. Flash Crashes, like car crashes, may be more severe the greater the velocity."[165] That the 2010 Flash Crash started in the E-Mini S&P 500 futures market, one of the most liquid in the world, seems only to add force to Mr. Haldane's argument.

3. Market Stability and Systemic Risk Concerns

Systemic risk can refer to many things, but in this article, it refers to the possibility that a certain contingency, event, or series of events could severely disrupt market operations. Using this definition, HFT increases systemic risk by making markets less resilient to serious market shocks. First, Reg. NMS has made stock markets more interdependent and corre-

158. Alain Chaboud, et al., *Rise of the Machines: Algorithmic Trading in the Foreign Exchange Market*, 69 J. FIN. 2045, 2066 (2014).

159. Brogaard et al., *supra* note 14.

160. *See id.* at 32-33.

161. Didier Sornette and Susanne von der Becke, *Crashes and High Frequency Trading* 6 (Swiss Fin. Inst. Research Paper No. 11-63, 2011), http://ssrn.com/abstract=1976249.

162. *Id.*

163. Ilia Dichev, Kelly Huang & Dexin Zhou, *The Dark Side of Trading* 30 (Emory L. & Econ. Research Paper No. 11-95, 2011), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1754215.

164. *Id.*

165. Andrew Haldane, Race to Zero, Address Before the Int. Econ. Ass'n Sixteenth World Congress (July 8, 2011), http://www.bankofengland.co.uk/publications/speeches /2011/speech509.pdf.

lated.[166] Many HFT firms employ similar strategies, suggesting that shocks hitting a few active HFT firms can have knock-on effects detrimentally affecting multiple exchanges, trading platforms, and investors.[167] The effects may not be limited to one particular asset class: HFT also exacerbates price shocks between derivatives and their underlying assets, between stocks and their ETFs, or between foreign stocks and their corresponding ADRs. This makes markets move together, implying higher levels of systemic risk.[168]

Second, HFT firms rely on pre-programmed algorithms to make thousands of trading decisions every second based on many assumed market conditions. Small programmatic errors or changes in trading conditions can affect HFT algorithms in unexpected ways, leading to potentially significant trading errors and major disruptions across multiple markets.[169] This is a particular worry with algorithms interpreting qualitative data since it is harder for them to determine whether it contains mistakes or errors. Again, it is extremely difficult for HFT firms, let alone regulators, to isolate and correct their strategies on a real-time basis since these strategies can place orders in multiple venues across different markets.[170]

Third, even if HFT does not cause a particular market disruption, these strategies can still exacerbate its effects. HFT firms have no market-making obligation to maintain "fair and orderly markets."[171] Consequently, HFT firms, especially those using aggressive or predatory strategies, can freely withdraw from the market during periods of stress, resulting in a dearth of liquidity at critical junctures. These market exits in turn risk transmitting illiquidity across markets, increasing systemic risk.[172]

4. Investor Protection and Market Integrity Concerns

The directional strategies outlined in Part I.C.3 illustrate how certain HFT strategies can exploit and harm other traders.[173] It is an open debate, however, as to exactly which investors these strategies harm the most. One study found that on a per contract basis, traders who focused on company-specific events when determining whether to buy or sell a stock (i.e. fundamentals traders) incurred the least cost to HFT whereas small traders incurred the most.[174] The study also noted that the fundamentals traders

166. *See* Kristin Forbes & Roberto Rigobon, *No Contagion, Only Interdependence: Measuring Stock Market Co-Movements*, 57 J. FIN. 2223, 2242 (2002).

167. Brogaard finds that NASDAQ HFTs tend to place market and limit orders in the same direction over various time intervals. *See* Brogaard et al., *supra* note 14.

168. *See* Forbes & Rigobon, *supra* note 162.

169. *See* Bernard S. Donefer, *Algos Gone Wild: Risk in the World of Automated Trading Strategies*, 5 J. TRADING 31 (2010).

170. *Id.*

171. *See* PATTERSON, *supra* note 8, at 260-77 (2012).

172. Kirilenko et al., *supra* note 18.

173. *See* CFTC v. Moncada, 31 F. Supp. 3d 614, 616-18 (S.D.N.Y. 2014).

174. *See* Baron, *supra* note 89.

were more likely to be large institutions while the small traders were more likely to be retail investors.[175] Blackrock, in contrast, asserted that HFT generally does not affect retail investors since their orders are small and usually filled completely and immediately at the NBBO.[176] In a similar vein, other studies concluded that institutional investors, at least when trading against *order anticipation* and *momentum ignition strategies*, incurred higher transaction costs than retail investors.[177] Another framing of the issue differentiates between fundamentals and non-fundamentals traders. Short-term HFT strategies are more prone to herd to the same information, driving a security's price further away from the price dictated by its fundamentals.[178] Put differently, the more momentum traders there are, the more likely it is a security's price will diverge from its fundamentals and the less likely it is that fundamentals trader will be successful.

Despite this mixed empirical evidence, the widespread belief that HFT operates unchecked has decreased investor confidence. Fear of manipulative HFT has driven some retail investors out of the market. For instance, a recent poll of consumer confidence found that only 15% of respondents "trust[ed]" stock markets.[179] Alarmingly, many also feel that HFT is responsible for creating a "two-tiered" secondary market.[180] HFT firms often pay exchanges huge sums to get direct access to their trade data and place their servers near to their order processing servers, known as colocation.[181] Many market centers also give HFTs customized order types that help these trading strategies work more effectively.[182] Several of these order types, harm market transparency, increase market complexity, and create situations where certain HFT strategies can unfairly exploit non-HFT investors.

Professor Charles Korsmo has defended the current market structure by pointing to its more "democratic" virtues. Anyone can get open access to co-location, data feeds, and specialized order types if they are willing to pay for them, resulting in a system which is "far more 'democratic' than what came before."[183] He further points to decreasing HFT profits as mar-

175. *Id.*

176. BLACKROCK, *US Equity Market Structure: An Investor Perspective*, http://www.blackrock.com/corporate/en-es/literature/whitepaper/viewpoint-us-equity-market-structure-april-2014.pdf.

177. *See* Lin Tong, *A Blessing or a Curse? The Impact of High Frequency Trading on Institutional Investors*, (Euro. Fin. Ass'n 2014 Paper Series, Oct. 13, 2015).

178. Ken Froot, David Scharfstein, & Jeremy Stein, *Herd on the Street: Informational Inefficiencies in a Market with Short-Term Speculation*, 47 J. FIN. 1461 (1992).

179. Merrin, *supra* note 22.

180. *See* Bullock, *supra* note 87.

181. *See, e.g.*, Keri Geiger and Sam Mamudi, *High-Speed Trading Faces New York Probe Into Fairness*, BLOOMBERG (Mar. 18, 2014), http://www.bloomberg.com/news/articles/2014-03-18/high-speed-trading-said-to-face-n-y-probe-into-fairness.

182. PATTERSON, *supra* note 8, at 48-49.

183. *See* Korsmo, *supra* note 143.

kets adapt to its presence.[184] These arguments, however, do not negate the need to boost investor confidence. Policymakers must root out remnants of unfairness to ensure investors continue participating in the capital-raising process.

Conclusion

HFT is an intricate solution to intricate problems. Yet as is often the case, regulators face even more complex problems than before. This article has tried to identify these problems in a way that does not obscure HFT's historical origins or the ways it has helped markets grow and investors prosper. Instead, it offers a baseline platform off which intelligent discussion regarding HFT can take place. As they say, and as is especially relevant here, you must be able to walk before you can run.

184. *Id.*