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## The New Market Manipulation

Tom C. W. Lin

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# THE NEW MARKET MANIPULATION

Tom C.W. Lin\*

## ABSTRACT

*Markets face a new and daunting mode of manipulation. With this new mode of market manipulation, millions of dollars can vanish in seconds, rogue actors can halt the trading of billion-dollar companies, and trillion-dollar financial markets can be distorted with a simple click or a few lines of code. Every investor and institution is at risk. This is the new precarious reality of our financial markets.*

*This Article is about our ominous financial reality, this dangerous new mode of market manipulation, and the need for pragmatic policies to better address the rising threats to manipulate our financial markets. To start, the Article offers an overview about the recent rise and regulation of new financial technology. It begins with a close examination of The Flash Crash of 2010 and the publication of Flash Boys by Michael Lewis. Next, the Article surveys the changing landscape of market manipulation. It identifies traditional manipulation methods like cornering, front running, and pumping-and-dumping, as well as new manipulation methods like spoofing, ping, and mass misinformation. It explains how new cybernetic market manipulation schemes that leverage modern technologies like electronic networks, social media, and artificial intelligence are more harmful than traditional schemes. The Article then grapples with why this new mode of market manipulation will present critical challenges for regulators. Finally, it recommends three pragmatic proposals for combating the new threats of cybernetic market manipulation by improving intermediary integrity, enhancing financial cybersecurity, and simplifying investment strategies. Ultimately, this Article provides an original and improved framework for thinking and acting anew about market regulation, market operations, and market manipulation.*

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## INTRODUCTION

Wall Street is an illusion.<sup>1</sup> The New York Stock Exchange, the real-time tickers, the traders, the bankers, the brokers, and the bronze charging bull all create the image that Wall Street, and its people make up the center of a transparent, fair, and efficient financial universe. In reality, much of the action today takes place far below and far away from Wall Street—in machines, data centers, super computers, and fiber optic cables located in anonymous buildings on non-descript streets.<sup>2</sup> In this new financial reality, billions of dollars can disappear in minutes, a handful of individuals can fundamentally transform financial operations, a rogue actor can halt the trading of Fortune 500 companies, and trillion-dollar financial markets can be manipulated with a simple click or a few lines of code.<sup>3</sup>

In the Fall of 2015, the perils of this new financial reality manifested in an unprecedented Department of Justice announcement of charges against three individuals who allegedly hacked numerous American banks and businesses, “perpetrated one of the largest thefts of financial-related data in history,” engaged in massive dissemination of fraudulent market information, and orchestrated a global, multi-million dollar stock manipulation scheme.<sup>4</sup>

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<sup>1</sup> See, e.g., JUSTIN FOX, *THE MYTH OF THE RATIONAL MARKET: A HISTORY OF RISK, REWARD, AND DELUSION ON WALL STREET* 280–83 (2009); Jonathan R. Macey & Maureen O’Hara, *From Markets to Venues: Securities Regulation in an Evolving World*, 58 STAN. L. REV. 563, 563 (2005); Lynn A. Stout, *Are Stock Markets Costly Casinos? Disagreement, Market Failure, and Securities Regulation*, 81 VA. L. REV. 611, 625–28 (1995).

<sup>2</sup> See SCOTT PATTERSON, *DARK POOLS: HIGH-SPEED TRADERS, AI BANDITS, AND THE THREAT TO THE GLOBAL FINANCIAL SYSTEM* 233–78 (2012).

<sup>3</sup> See, e.g., Graham Bowley, *Lone Sale of \$4.1 Billion in Contracts Led to ‘Flash Crash’ in May*, N.Y. TIMES (Oct. 1, 2010), <http://www.nytimes.com/2010/10/02/business/02flash.html> [<https://perma.cc/6W26-DDR2>]; Matthew Goldstein, *S.E.C. Charges Man in Bulgaria in Fake Takeover Offer for Avon*, N.Y. TIMES (June 4, 2015), [https://www.nytimes.com/2015/06/05/business/dealbook/sec-charges-bulgarian-man-in-fake-takeover-offer-for-avon.html?\\_r=0](https://www.nytimes.com/2015/06/05/business/dealbook/sec-charges-bulgarian-man-in-fake-takeover-offer-for-avon.html?_r=0) [<https://perma.cc/A5BM-92FQ>]; Michael Lewis, *The Wolf Hunters of Wall Street*, N.Y. TIMES MAG. (Mar. 31, 2014), <https://www.nytimes.com/2014/04/06/magazine/flash-boys-michael-lewis.html> [<https://perma.cc/G42L-R6H8>]; Nicole Perloth, *Hackers Using Lingo of Wall St. Breach Health Care Companies’ Email*, N.Y. TIMES (Dec. 1, 2014), <https://www.nytimes.com/2014/12/02/technology/hackers-target-biotech-companies.html> [<https://perma.cc/YS8P-NBZT>].

<sup>4</sup> See Press Release, DOJ, Attorney General and Manhattan U.S. Attorney Announce Charges Stemming from Massive Network Intrusions at U.S. Financial Institutions, U.S. Brokerage Firms, a Major News Publication, and Other Companies (Nov. 10, 2015), <http://www.justice.gov/usao-sdny/pr/attorney-general-and-manhattan-us-attorney-announce-charges-stemming-massive-network> [hereinafter *Massive Network Intrusions Press Release*]; see also Indictment, *United States v. Shalon*, S1 15 Cr. 333 (S.D.N.Y. 2015), <http://www.justice.gov/usao-sdny/file/792506/download>; Indictment, *United States v. Murgio*, 15 Cr. 769 (S.D.N.Y. 2015), <http://www.justice.gov/usao-sdny/file/792511/download>; Matthew Goldstein & Alexandra Stevenson, *Nine Charged in Insider Trading Case Tied to Hackers*, N.Y. TIMES (Aug. 11, 2015), [https://www.nytimes.com/2015/08/12/business/dealbook/insider-trading-sec-hacking-case.html?\\_r=0](https://www.nytimes.com/2015/08/12/business/dealbook/insider-trading-sec-hacking-case.html?_r=0) [<https://perma.cc/R7PV-Q74L>]; Nicole Hong, *Two Accused in J.P. Morgan Hacking Case Plead Not Guilty*,

According to the unsealed indictments, the hackers generated over \$100 million in illicit gains using only their computers to hack into private servers and manipulate the markets for certain stocks.<sup>5</sup> Preet Bharara, then U.S. Attorney for the Southern District of New York, described their criminal market manipulation activities as “securities fraud on cyber steroids.”<sup>6</sup>

This Article is about this new, perilous financial reality, the emerging mode of new market manipulation, and the need for better pragmatic policies to address the rising technological threats to manipulate financial markets. This Article offers an original, early examination of the new high-tech forms of market distortions that it calls *cybernetic market manipulation*, explains the critical consequences of these dangerously disruptive actions on the marketplace, and proposes sensible policies to better protect investors and safeguard the financial system.

Building on the author’s previous works on new financial technology, and drawing upon a growing literature relating to modern financial regulation, this Article seeks to make three contributions.<sup>7</sup> First, it aims to provide a cogent,

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WALL ST. J. (June 9, 2016, 5:02 PM), <https://www.wsj.com/articles/two-accused-in-j-p-morgan-hacking-case-plead-not-guilty-1465505356> [<https://perma.cc/G877-4LRN>].

<sup>5</sup> See Indictment, *Shalon*, S1 15 Cr. 333, at 4; see also Indictment, *Murgio*, 15 Cr. 769, at 1; Goldstein & Stevenson, *supra* note 4.

<sup>6</sup> See Portia Crowe, *BHARARA: The JPMorgan Hackers Committed ‘Securities Fraud on Cyber Steroids’*, BUS. INSIDER (Nov. 10, 2015, 1:27 PM), <http://www.businessinsider.com/preet-bharara-on-jpmorgan-hackers-2015-11> [<https://perma.cc/4ATP-98U7>].

<sup>7</sup> In the years since the Financial Crisis of 2008, the scholarly inquiry into financial innovation and financial regulation has been a burgeoning field of legal research. See, e.g., Stephen M. Bainbridge, *Dodd-Frank: Quack Federal Corporate Governance Round II*, 95 MINN. L. REV. 1779 (2011) (discussing why the Dodd-Frank Act will have adverse consequences); William A. Birdthistle & M. Todd Henderson, *Becoming a Fifth Branch*, 99 CORNELL L. REV. 1, 12–24 (2013) (describing the development of securities regulations and SROs); John C. Coffee, Jr., *The Political Economy of Dodd-Frank: Why Financial Reform Tends to Be Frustrated and Systemic Risk Perpetuated*, 97 CORNELL L. REV. 1019 (2012) (analyzing different theories about why reform legislation flounders); Jill E. Fisch, *Top Cop or Regulatory Flop? The SEC at 75*, 95 VA. L. REV. 785 (2009) (arguing that the SEC lacks “functional effectiveness” when regulating); Merritt B. Fox, Lawrence R. Glosten & Gabriel V. Rauterberg, *The New Stock Market: Sense and Nonsense*, 65 DUKE L.J. 191 (2015) (proposing a new framework for analyzing the stock market using “adverse selection, the principal-agent problem, and a multivalue trading system”); Erik F. Gerding, *Code, Crash, and Open Source: The Outsourcing of Financial Regulation to Risk Models and the Global Financial Crisis*, 84 WASH. L. REV. 127 (2009) (finding that the current industry risk models are inadequate and dangers arise from the new financial code); Kathryn Judge, *Fragmentation Nodes: A Study in Financial Innovation, Complexity, and Systemic Risk*, 64 STAN. L. REV. 657 (2012) (assessing methods beyond mere disclosure to deal with financial innovation and systemic risk); Charles R. Korsmo, *High-Frequency Trading: A Regulatory Strategy*, 48 U. RICH. L. REV. 523 (2014) (considering how to regulate high-frequency trading post-Flash Crash); Donald C. Langevoort & Robert B. Thompson, “Publicness” in *Contemporary Securities Regulation After the JOBS Act*, 101 GEO. L.J. 337 (2013) (contemplating the meaning of being a public corporation); Adam J. Levitin, *The Politics of Financial*

early narrative for understanding and explaining the new financial marketplace. Second, it aims to highlight the emerging ways that new financial technologies, electronic communications, and information systems can be leveraged to manipulate financial markets to unfairly privilege the few to the detriment of the many. Third, it aims to recommend workable steps that policymakers and investors should consider to better secure the integrity of the marketplace against new modes of market manipulation. Undoubtedly, pursuing these objectives in a rapidly evolving, dynamic marketplace will necessarily result in a dated and daunting work in progress. Nevertheless, however dated and daunting, such an endeavor is also a useful and worthy one for it can offer insight about the profound, unfolding changes in our marketplace and shed light on the future of financial markets and market manipulation. Ultimately, this Article aspires to provide an original and effective framework for policymakers to think and act anew about market regulation, market operations, and market manipulation.

This Article constructs this framework in five parts. Part I provides background. It examines the Flash Crash of 2010 and the publication of *Flash Boys* by Michael Lewis, two seminal events that brought market manipulation and new financial technology to the forefront of public attention.<sup>8</sup> First, it explores the Flash Crash, an unprecedented market event where a trillion dollars disappeared from the marketplace in a matter of minutes. It critiques the 2010 joint investigative report of the Securities and Exchange Commission (SEC) and the Commodity Futures Trading Commission (CFTC) on the event, and the subsequent arrest of a trader in connection with the Flash Crash five years later in 2015. Second, Part I studies the facts and fallout associated with the publication of *Flash Boys*, a book that lifts the veil on the illusion that is

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*Regulation and the Regulation of Financial Politics: A Review Essay*, 127 HARV. L. REV. 1991 (2014) (reviewing the literature relating to the Financial Crisis); Tom C.W. Lin, *The New Financial Industry*, 65 ALA. L. REV. 567 (2014) (explaining the rise of technology on Wall Street and a framework for regulating this new area); Saule T. Omarova, *Wall Street as Community of Fate: Toward Financial Industry Self-Regulation*, 159 U. PA. L. REV. 411 (2011) (contending that more self-regulation could be used in the financial industry); Steven L. Schwarcz, *Regulating Complexity in Financial Markets*, 87 WASH. U. L. REV. 211 (2009) (comparing complex financial markets and complex engineering systems); Robert B. Thompson, *Market Makers and Vampire Squid: Regulating Securities Markets After the Financial Meltdown*, 89 WASH. U. L. REV. 323 (2011) (evaluating intermediary behaviors to understand where regulation would be effective); Charles K. Whitehead, *The Goldilocks Approach: Financial Risk and Staged Regulation*, 97 CORNELL L. REV. 1267, 1270 (2012) (cautioning that regulation should be done in timed stages rather than broad strokes).

<sup>8</sup> See generally U.S. COMMODITY FUTURES TRADING COMM'N & U.S. SECS. & EXCH. COMM'N, FINDINGS REGARDING THE MARKET EVENTS OF MAY 6, 2010 (2010), [hereinafter CFTC & SEC FINDINGS] <http://www.sec.gov/news/studies/2010/marketevents-report.pdf> (detailing government investigation into the Flash Crash); MICHAEL LEWIS, *FLASH BOYS: A WALL STREET REVOLT* (2014) (examining the events leading up to the Flash Crash).

contemporary Wall Street and reveals the fraught manipulative inner workings of American capital markets. Through the remarkable tale of an unlikely band of reformers and their battle against high frequency traders, the book explains and exposes how new financial technology has created new ways to “rig” markets.<sup>9</sup> Part I establishes a foundation for discussing market manipulation and the new financial reality.

Building on that foundation, Part II offers wider context. It does so by connecting the Flash Crash and *Flash Boys* to the larger sea change occurring in the financial markets. It explains why the Flash Crash and *Flash Boys* are truly about much larger happenings in the financial marketplace. It provides a descriptive and normative perspective on the rise of new financial technology and the early regulatory response to it. It analyzes the advances and challenges of the new financial reality on the integrity of the marketplace with the emergence of new methods of market manipulation. It inquires into the larger legal and policy issues surrounding innovation, regulation, and risk in the new financial marketplace. Part II explains and exposes the unfolding context of our financial markets and the new mode of market manipulation.

Part III moves from context to action. It explores the evolving methods of market manipulation given new financial realities. It begins by categorizing common traditional methods of market manipulation like cornering, squeezing, front running, pumping-and-dumping, and benchmark distortion. Part III then identifies emerging high-tech methods of market manipulation like spoofing, ping-pong, and mass misinformation. Using recent manipulation schemes involving hacking, social media, and artificial intelligence as illustrative examples, it explains why the new high-tech mode of cybernetic market manipulation that leverages the electronic communications, information systems, and algorithmic platforms of the modern financial marketplace is more harmful and impactful than those of its traditional predecessors.<sup>10</sup> Part III identifies and highlights the new problematic means to disrupt, distort, and manipulate financial markets that damage market value and investor confidence.

Part IV foreshadows regulatory problems. It grapples with why new methods of cybernetic market manipulation will prove to be so challenging for regulators. It explains how core matters relating to resources, detection, and enforcement

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<sup>9</sup> LEWIS, *supra* note 8, at 34, 79, 89, 226.

<sup>10</sup> See, e.g., Shaun D. Ledgerwood & Paul R. Carpenter, *A Framework for the Analysis of Market Manipulation*, 8 REV. L. & ECON. 253, 282–84 (2012) (discussing the various harms caused by market manipulation).

will likely prevent regulators from effectively addressing new methods of manipulation in the emerging, high-tech financial marketplace that is increasingly autonomous, data-driven, and fragmented. Part IV contends with the interlocking challenges of reform, risk, and reward that accompany financial innovation and regulation.

Part V turns from problems to solutions. It anticipates the implications caused by cybernetic market manipulation, and recommends three pragmatic policies that should be considered to better address the harms caused by the new modes of cybernetic manipulation in the near term. It argues for improving intermediary integrity, enhancing financial cybersecurity, and simplifying investment strategies. Admittedly, these proposals will not cure all of the emerging manipulative ills posed by the new financial reality. Instead, they offer sensible solutions that can be implemented in the near term to better safeguard investors and the marketplace from manipulation while larger issues are being debated and deliberated. Part V presents an early sketch of new paths forward for addressing cybernetic market manipulation in the coming years.

Finally, this Article closes with a brief conclusion. It recounts the challenges inherent in regulating an incredibly dynamic financial marketplace, and echoes the urgent call for more nuanced and more workable understandings of new market realities and new market manipulation.

## I. THE FLASH CRASH AND *FLASH BOYS*

Two seminal events in recent history brought the hard truths of new financial technology and market manipulation to the forefront of general public consciousness. The first event was the unprecedented trading session of the American stock market on May 6, 2010, that is now simply known as the Flash Crash.<sup>11</sup> The second event was the publication of Michael Lewis's book, *Flash Boys*, on March 31, 2014.<sup>12</sup> Both events establish an early foundation and shed insightful light for better understanding the evolution of modern markets and market manipulation.

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<sup>11</sup> CFTC & SEC FINDINGS, *supra* note 8, at 1.

<sup>12</sup> *New Book by Michael Lewis to Pub This Spring*, W.W. NORTON & COMPANY, INC. (Jan. 15, 2014), <http://books.wwnorton.com/books/news.aspx?id=4294981077>.

## A. *The Flash Crash*

### 1. *The Initial Story*

On May 6, 2010, the American stock market, the most valuable and respected capital market in the world, experienced a trading session of unprecedented volatility and velocity.<sup>13</sup> The trading day opened at 9:30 a.m. (EST) with news about social unrest in Greece as a response to government actions related to the country's debt.<sup>14</sup> For the first few hours, the markets moved like they did for most ordinary trading sessions. Suddenly, around 2:40 p.m., the markets experienced a sharp decline and volatility that would last for about twenty minutes.<sup>15</sup> In the span of less than thirty very volatile minutes, approximately \$1 trillion in market value vanished from the U.S. stock market.<sup>16</sup> During this volatile period, hundreds of securities, including those of blue chip companies, traded at absurd prices, ranging from a penny per share to \$100,000 per share.<sup>17</sup> Following the precipitous decline, the market began to rebound rapidly, recovering the bulk of the losses.<sup>18</sup> The volatile trading session of May 6, 2010, is now simply referred to as the Flash Crash.<sup>19</sup>

Following the Flash Crash, the SEC and CFTC initiated a joint investigation and issued a report on September 30, 2010, about their findings.<sup>20</sup> According to the report, the Flash Crash was likely initiated by a futures order from Waddell & Reed, a Kansas mutual fund company.<sup>21</sup> At approximately 2:32 p.m., with a high-speed, automated computer program, Waddell & Reed created an order to sell \$4.1 billion of E-Mini S&P futures contracts.<sup>22</sup> These futures tracked the movement of the S&P 500 Index (S&P 500), which measures the performance of America's 500 largest publicly traded companies.<sup>23</sup> Waddell & Reed's program executed the order "without regard to price or time," meaning the program would automatically continue to sell the contracts even if the price

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<sup>13</sup> CFTC & SEC FINDINGS, *supra* note 8, at 1.

<sup>14</sup> *Id.* at 9.

<sup>15</sup> *Id.*

<sup>16</sup> Andrew G. Haldane, Exec. Dir. Fin. Stability, Bank of Eng., *The Race to Zero*, Speech at the International Economic Association Sixteenth World Congress (July 8, 2011), at <http://www.bankofengland.co.uk/archive/Documents/historicpubs/speeches/2011/speech509.pdf>.

<sup>17</sup> CFTC & SEC FINDINGS, *supra* note 8, at 1.

<sup>18</sup> *Id.* at 9.

<sup>19</sup> Bowley, *supra* note 3.

<sup>20</sup> *See* CFTC & SEC FINDINGS, *supra* note 8.

<sup>21</sup> *Id.* at 2; Bowley, *supra* note 3.

<sup>22</sup> CFTC & SEC FINDINGS, *supra* note 8, at 2.

<sup>23</sup> *Id.*

dropped and for however long it took to fulfill the order.<sup>24</sup> The entire order was fulfilled in about twenty minutes.<sup>25</sup> In years past, because of technological limitations, an order of this size would have normally taken several hours or days to complete.<sup>26</sup>

A few minutes after the fulfillment of Waddell & Reed's order, the computerized trading programs of other market participants executed corresponding high-speed trades in the futures and equity markets that caused significant volatility and liquidity issues in the equity and futures markets.<sup>27</sup> Within twenty minutes after Waddell & Reed's initial trade, S&P futures experienced a 3% drop,<sup>28</sup> and the Dow Jones Industrial Average (Dow) experienced a 9.16% drop, which amounted to nearly 1000 points.<sup>29</sup> During the Dow's swift free fall, share prices in individual stocks also experienced rapid declines. Blue-chip stocks like Proctor & Gamble and 3M each suffered losses nearing or exceeding 20%, or billions of dollars in market capitalization.<sup>30</sup> Shares of Accenture, a leading consulting company, plummeted by over 99%, from \$40 to \$0.01.<sup>31</sup> On the flipside, shares of Sotheby's, the famed auction house, increased three thousand-fold, from \$34 to \$99,999.99.<sup>32</sup> At the end of the unprecedented trading day, the major futures and equity indexes closed with losses of about 3% relative to the previous day.<sup>33</sup>

The turbulent last few hours of the trading day on May 6, 2010, resembled a rollercoaster ride with trillions of dollars at stake. The *Wall Street Journal* visually summarized the Flash Crash as follows:<sup>34</sup>

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<sup>24</sup> Bowley, *supra* note 3.

<sup>25</sup> CFTC & SEC FINDINGS, *supra* note 8, at 2.

<sup>26</sup> *See id.*

<sup>27</sup> *Id.* at 3.

<sup>28</sup> *Id.*

<sup>29</sup> *See* David M. Serritella, *High Speed Trading Begets High Speed Regulation: SEC Response to Flash Crash*, *Rash*, 2010 U. ILL. J.L. TECH. & POL'Y 433, 435.

<sup>30</sup> CFTC & SEC FINDINGS, *supra* note 8, at 84–85.

<sup>31</sup> *Id.* at 83; Haldane, *supra* note 16.

<sup>32</sup> Haldane, *supra* note 16.

<sup>33</sup> CFTC & SEC FINDINGS, *supra* note 8, at 1.

<sup>34</sup> Matt Phillips, *Flash Crash Anniversary: Relive the Thrills and Spills in Charts!*, WALL ST. J.: MARKETBEAT (May 6, 2011, 10:40 AM), <http://blogs.wsj.com/marketbeat/2011/05/06/flash-crash-anniversary-relive-the-thrills-and-spills-in-charts/> [<https://perma.cc/YC2Q-FQVS>].

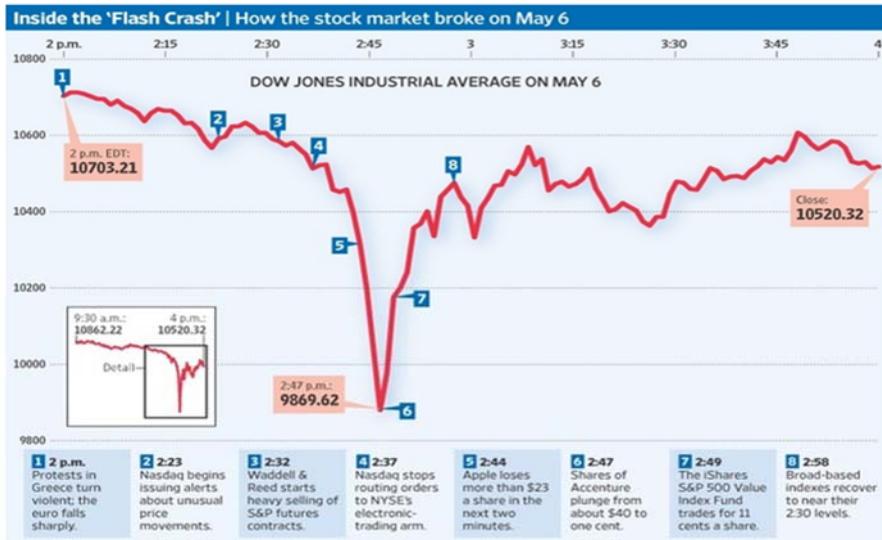


Figure 1: *Wall Street Journal* Timeline of the May 6, 2010, Flash Crash.

Ultimately, the SEC and CFTC joint inquiry did not blame the Flash Crash on manipulative conduct or illegal behavior.<sup>35</sup> The inquiry also did not blame the Flash Crash entirely on automated algorithmic trading programs. Instead, the inquiry's preliminary conclusion was that such traders and programs played a critical role in eroding liquidity and exacerbating volatility on the day of the Flash Crash, but did not cause the "extreme volatility in security prices observed that day."<sup>36</sup> In addition to their preliminary findings, the SEC and the CFTC also pledged to better safeguard the integrity and reliability of the marketplace against "any unintentional or potentially abusive or manipulative conduct" that may lead to price distortions.<sup>37</sup>

## 2. *The Trillion-Dollar Man*

In April of 2015, nearly five years after the Flash Crash, Navinder Singh Sarao was arrested at his home outside of London for market manipulation that allegedly contributed to the trillion-dollar crash.<sup>38</sup> Sarao was charged by the

<sup>35</sup> CFTC & SEC FINDINGS, *supra* note 8, at 79.

<sup>36</sup> *Id.* at 79.

<sup>37</sup> *Id.* at 8.

<sup>38</sup> See *Futures Trader Charged with Illegally Manipulating Stock Market, Contributing to the May 2010 Market 'Flash Crash'*, DOJ (Apr. 21, 2015) [hereinafter *Futures Trader*], <http://www.justice.gov/opa/pr/futures-trader-charged-illegally-manipulating-stock-market-contributing-may-2010-market-flash>; see also John

Department of Justice (DOJ) for criminal violations as well as by the CFTC for civil violations.<sup>39</sup>

The complaints by the DOJ and the CFTC detailed that Sarao was being charged with “one count of wire fraud, ten counts of commodities fraud, ten counts of commodities manipulation, and one count of ‘spoofing,’ a practice of bidding or offering with the intent to cancel the bid or offer before execution.”<sup>40</sup> According to unsealed court documents, Sarao allegedly designed and used algorithmic computer programs to manipulate the futures contracts tied to the S&P 500 Index.<sup>41</sup> Specifically, he allegedly manipulated the market for E-Mini S&P 500 futures contracts being traded on the Chicago Mercantile Exchange.<sup>42</sup> He allegedly did so by flooding the market with large volumes of fraudulent trade orders that distorted the price of the E-Mini futures to his advantage.<sup>43</sup> According to the DOJ, Sarao manipulated futures contracts tied to the S&P 500 over the course of many years, including in the days and hours leading up to the Flash Crash, which netted him \$40 million in ill-gotten gains.<sup>44</sup>

In November of 2016, after fighting extradition to the United States for over a year, Sarao pleaded guilty to wire fraud and spoofing.<sup>45</sup>

The case of Sarao led to much disquiet and many questions in the marketplace.<sup>46</sup> How does one reconcile the arrest of Sarao with the initial

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Detrixhe & Suzi Ring, *Study Says Sarao May Not Have Been Responsible for Flash Crash*, BLOOMBERG (Jan. 27, 2016), <http://www.bloomberg.com/news/articles/2016-01-27/hound-of-hounslow-s-flash-crash-blame-questioned-before-hearing> [https://perma.cc/BR55-ZWLH].

<sup>39</sup> See *Ex Parte* Motion, CFTC v. Nav Sarao Futures Ltd. PLC, No. 15-cv-3398, 2015 WL 2456322 (N.D. Ill. Apr. 17, 2015); see also Consent Order, CFTC v. Nav Sarao Futures Ltd. PLC, No. 15-cv-3398, 2016 WL 8257513 (N.D. Ill. Nov. 14, 2016); Complaint, CFTC v. Nav Sarao Futures Ltd. PLC, No. 15-cv-3398, 2015 WL 1843321 (N.D. Ill. Apr. 17, 2015).

<sup>40</sup> *Futures Trader*, *supra* note 38.

<sup>41</sup> See Complaint, *Sarao*, No. 15-cv-3398, 2015 WL 1843321.

<sup>42</sup> *Id.*

<sup>43</sup> *Id.*

<sup>44</sup> *Id.*

<sup>45</sup> Aruna Viswanatha, *‘Flash Crash’ Trader Navinder Sarao Pleads Guilty to Spoofing*, WALL ST. J. (Nov. 10, 2016, 10:26 AM), <http://www.wsj.com/articles/flash-crash-trader-navinder-sarao-pleads-guilty-to-spoofing-1478733934> [https://perma.cc/A9TH-LVW4].

<sup>46</sup> See, e.g., Tim Cave, Juliet Samuel & Aruna Viswanatha, *U.K. ‘Flash Crash’ Trader Navinder Sarao Fighting Extradition to U.S. Granted Bail*, WALL ST. J. (Apr. 22, 2015, 7:28 PM), <http://www.wsj.com/articles/u-k-trader-navinder-sarao-vows-to-fight-u-s-extradition-plans-1429705635> [https://perma.cc/CRG3-9GCX]; Julia La Roche, *Wall Street Can’t Stop Talking About the ‘Ridiculous’ Arrest of the ‘Flash Crash’ Trader*, BUS. INSIDER (Apr. 25, 2015, 2:40 PM), <http://www.businessinsider.com/arrest-of-nav-sarao-is-ridiculous-2015-4> [https://perma.cc/3EP4-YHVT]; Douwe Miedema & Ann Saphir, *Delayed Flash Crash Arrest May Herald Future Spoofing Detection Woes*, REUTERS (Apr. 23, 2015, 7:12 PM), <http://uk.reuters.com/article/2015/04/23/us-flashcrash-trader-cme-idUKKBN0NE01220150423> [https://perma.cc/SUT9-

findings of the SEC and CFTC? How can one man working from his house manipulate the multi-trillion dollar American financial market? Why did it take regulators five years to find and arrest him? How stable and safe are financial markets, if one trader with relatively little capital and technological capacity can cause such deleterious effects? While the answers to these and other questions remain open, regulators have taken a number of steps to better safeguard the stability and integrity of the marketplace against nefarious attempts to manipulate it in the years since the Flash Crash.<sup>47</sup> While another crash matching the velocity and magnitude of the Flash Crash has yet to materialize, there have been many smaller, more isolated episodes of market volatility and disruption.<sup>48</sup> Nevertheless, some experts and policymakers speculate that as markets become more technologically dependent, it will only be a matter of time before another major crash like the Flash Crash occurs again.<sup>49</sup>

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2ENW]; Nathaniel Popper & Jenny Anderson, *Trader Arrested in Manipulation That Contributed to 2010 'Flash Crash'*, N.Y. TIMES (Apr. 21, 2015), <https://www.nytimes.com/2015/04/22/business/dealbook/trader-in-britain-arrested-on-charges-of-manipulation-that-led-to-2010-flash-crash.html> [https://perma.cc/9BJL-GPHT]; James Surowiecki, *New Ways to Crash the Market*, NEW YORKER (May 18, 2015), <http://www.newyorker.com/magazine/2015/05/18/new-ways-to-crash-the-market> [https://perma.cc/4FSP-9KWN].

<sup>47</sup> For a discussion of the post-Flash Crash regulatory actions, see *infra* Part II.B.

<sup>48</sup> See Graham Bowley, *The Flash Crash, in Miniature*, N.Y. TIMES (Nov. 8, 2010), <http://www.nytimes.com/2010/11/09/business/09flash.html> [https://perma.cc/T5GH-APB7] (reporting on the occurrence of smaller flash crashes); Jacob Bunge, Justin Baer & Kaitlyn Kiernan, *Goldman Issues Mistaken Options Orders, Roiling Prices*, WALL ST. J. (Aug. 20, 2013, 10:26 PM), <https://www.wsj.com/articles/SB10001424127887324747104579024964124614096> [https://perma.cc/LC9L-S8RD]; Amy Chozick & Nicole Perloth, *Twitter Speaks, Markets Listen and Fears Rise*, N.Y. TIMES (Apr. 28, 2013), <http://www.nytimes.com/2013/04/29/business/media/social-medias-effects-on-markets-concern-regulators.html> [https://perma.cc/K8U7-7UU2] (describing the stock market crash caused by a false tweet); Shen Hong, *Everbright Securities Fiasco Casts a Shadow: Chinese Brokerage Leads Losses in Sector with 10% Decline*, WALL ST. J. (Aug. 20, 2013, 12:36 PM), <https://www.wsj.com/articles/SB10001424127887323608504579024360736416276> [https://perma.cc/E2EB-DVZL]; Edward E. Kaufman, Jr. & Carl M. Levin, *Preventing the Next Flash Crash*, N.Y. TIMES (May 5, 2011), <http://www.nytimes.com/2011/05/06/opinion/06kaufman.html> [https://perma.cc/F77B-HZVG] (discussing mini-crashes since the Flash Crash); Matt Krantz, *Mini Flash Crashes Worry Traders*, USA TODAY (May 17, 2011, 11:52 AM), [http://www.usatoday.com/money/markets/2011-05-16-mini-flash-crashes-market-worry\\_n.htm](http://www.usatoday.com/money/markets/2011-05-16-mini-flash-crashes-market-worry_n.htm) [https://perma.cc/V87G-GX7A]; Annie Massa, *Headaches Set In for Traders with NYSE Glitch Near Market Close*, BLOOMBERG (Mar. 21, 2017, 10:56 AM), <https://www.bloomberg.com/news/articles/2017-03-20/headaches-set-in-for-traders-with-nyse-glitch-near-market-close> [https://perma.cc/JD8K-QEZH]; Nathaniel Popper, *Flood of Errant Trades Is a Black Eye for Wall Street*, N.Y. TIMES (Aug. 1, 2012), <http://www.nytimes.com/2012/08/02/business/unusual-volume-roils-early-trading-in-some-stocks.html> [https://perma.cc/WA7S-P2T4] (discussing market instability caused by computerized trading relating to Facebook's initial public offering and a rogue computer program related to Knight Trading); Nathaniel Popper, *Stock Market Flaws Not So Rare, Data Shows*, N.Y. TIMES (Mar. 28, 2012), <http://www.nytimes.com/2012/03/29/business/mishap-at-bats-stock-exchange-is-indicative-of-market.html> [https://perma.cc/4GJ6-KCAF] (reporting on the volatility surrounding the initial public offering of BATS Global Markets, an electronic stock exchange pioneer).

<sup>49</sup> See Kaufman & Levin, *supra* note 48 (“[A]lgorithmic trading has caused mini-flash crashes since, and surveys suggest that most investors and analysts believe it’s only a matter of time before the Big One.”).

## B. Flash Boys: *A Wall Street Revolt*

In addition to the Flash Crash, the other seminal event in recent history that brought market manipulation and new financial technology to the forefront of public attention was the publication of Michael Lewis's *Flash Boys*. Published four years after the Flash Crash, *Flash Boys* tells the story of the advance and menace of high frequency trading on Wall Street, and the efforts of a small group of men to challenge it. The book, with its villains, heroes, and a compelling setting with billions of dollars at stake, grounds much of the recent and ongoing, high-level discussion about market manipulation and market reform.

### 1. *The Setting*

*Flash Boys* takes place in present-day Wall Street, a marketplace that is undergoing a fundamental shift. The book asserts that our popular conceptions about Wall Street and how the marketplace works are antiquated and wrong.<sup>50</sup>

There is a popular perception that the stock market is a transparent and fair human endeavor.<sup>51</sup> Men and women in crowded pits at august buildings like the New York Stock Exchange in downtown Manhattan take and execute trades on behalf of clients. Television channels like CNBC and Bloomberg broadcast live those images with real-time ticker scrolls indicating changes in stock price and volume. Generally, the marketplace is believed to be transparent, fair, and well regulated by agencies like the SEC.<sup>52</sup>

As chronicled by Lewis, the reality of the modern marketplace is quite different from the popular perception. It is less human, less transparent, and less fair than it is in the popular imagination of the public.<sup>53</sup> First, instead of humans, automated machines communicating through high-speed spectra and cables operate much of the marketplace.<sup>54</sup> In fact, in the United States today, powerful supercomputers running high-frequency algorithmic programs, devoid of human

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<sup>50</sup> LEWIS, *supra* note 8, at 3.

<sup>51</sup> *Id.* at 9, 40.

<sup>52</sup> See, e.g., Henry T.C. Hu, *Faith and Magic: Investor Beliefs and Government Neutrality*, 78 TEX. L. REV. 777, 840–42 (2000) (discussing how the SEC promotes the idea of a fair, well-regulated stock market).

<sup>53</sup> LEWIS, *supra* note 8, at 9–10, 40.

<sup>54</sup> See generally DAVID J. LEINWEBER, *NERDS ON WALL STREET: MATH, MACHINES, AND WIRED MARKETS* 31–64 (2009) (discussing past impact of technology in the marketplace and predicting use of future technology); PATTERSON, *supra* note 2, at 233–78; Felix Salmon & Jon Stokes, *Bull vs. Bear vs. Bot*, WIRED (Jan. 1, 2011), <https://www.questia.com/magazine/1P3-2268084801/bull-vs-bear-vs-bot> [<https://perma.cc/5P9V-J72K>] (“It’s the machines’ market now; we just trade in it.”).

assistance, conduct most equity trading.<sup>55</sup> Second, instead of one transparent stock market, much of the trading in today's market occurs in multiple dark pools and private exchanges that lack the light and transparency of public exchanges like the New York Stock Exchange and the NASDAQ.<sup>56</sup> A dark pool refers to a private, electronic trading forum that is not subject to the same type of regulation and scrutiny as the public stock exchanges.<sup>57</sup> According to Lewis, "[i]nside a dark pool, no one but the broker who ran it had any idea what was happening."<sup>58</sup> And, third, instead of being a fair, level playing field, Lewis argues that the market is "rigged" to the benefit of wealthy, high-speed traders and to the detriment of everyone else in the marketplace.<sup>59</sup> The truth of the matter is that in a marketplace moving at velocities measured in milliseconds, ordinary investors simply cannot compete with high-frequency traders—and their super powerful and speedy algorithms—even if they all receive actionable information at the same time.

In sum, a rapidly evolving modern marketplace for equity trading serves as the setting for the book's protagonists and antagonists in their contest for profit and principle.

## 2. *The Villains*

The villains of the book were unscrupulous high-frequency traders who used speed to unfairly manipulate the marketplace. Lewis argued that high-frequency traders used their superior speeds and connections to front run orders and route trades to dark pools unfavorable to many counterparties.<sup>60</sup>

High-frequency firms, therefore, gain an advantage in the marketplace by purchasing superior speed and connections. Through the process of co-location, high-frequency firms would purchase or lease real estate as close as possible to the servers and data centers of the exchanges.<sup>61</sup> This allows their high-speed

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<sup>55</sup> See Graham Bowley, *Fast Traders, in Spotlight, Battle Rules*, N.Y. TIMES (July 17, 2011), <http://www.nytimes.com/2011/07/18/business/fast-traders-under-attack-defend-work.html> [https://perma.cc/YV7C-2WFZ] (estimating that 60% of all equity trading consist of high-frequency trading).

<sup>56</sup> See LEWIS, *supra* note 8, at 42; Matthew Philips, *Where Has All the Stock Trading Gone?*, BLOOMBERG (May 10, 2012, 10:20 PM), <https://www.bloomberg.com/news/articles/2012-05-10/where-has-all-the-stock-trading-gone> [https://perma.cc/BYW5-AM3X].

<sup>57</sup> See BRIAN R. BROWN, CHASING THE SAME SIGNALS: HOW BLACK-BOX TRADING INFLUENCES STOCK MARKETS FROM WALL STREET TO SHANGHAI 116 (2010).

<sup>58</sup> LEWIS, *supra* note 8, at 43.

<sup>59</sup> See *id.* at 34, 79, 89, 226.

<sup>60</sup> *Id.* at 70–84.

<sup>61</sup> *Id.* at 79.

machines to reduce the time it takes to execute a trade by fractions of a second.<sup>62</sup> Since speed is so important in the machine-driven modern marketplace, any time difference, however small, confers a huge advantage to the faster party.

In addition to co-location, high-frequency firms also have superior connections to exchanges and dark pools via special access to high-speed cables and order feeds.<sup>63</sup> This special access allowed such firms to maintain their advantage in velocity, and the access to the order feeds conferred an informational advantage to the firms over other market participants. Together, the edge in speed and information tilted the playing field to the advantage of high-frequency firms. First, because high-frequency firms were permitted to see the order flows coming into a dark pool or exchange, they could use their superior speed to jump ahead of your order in that exchange and other exchanges.<sup>64</sup> Then, they would buy the stock you wanted to buy and sell it right back to you at a premium.<sup>65</sup> Lewis likened this predatory practice to front running that exacted a tax on the entire marketplace, amounting to \$160 million a day.<sup>66</sup> Second, because of their superior speed, high-frequency firms were able to manipulate the marketplace by submitting and canceling millions of trades daily as a means to discern the intentions of other investors.<sup>67</sup> These firms accounted for half of the trades in the stock market, yet they submitted over 99% of the orders.<sup>68</sup> Third, with their superior speed and technology, high-frequency firms could manipulatively route and re-route customer orders to forums that were more advantageous to the firms themselves relative to their customers.<sup>69</sup>

According to the book, high-frequency firms had rigged the entire American stock market to their benefit, so that they would always win and everyone else would lose (a little or a lot).<sup>70</sup> In his telling, “[w]hat had once been the world’s

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<sup>62</sup> *Id.*

<sup>63</sup> *See id.* at 51–55, 180–85; *see also* Order Instituting Administrative and Cease-and-Desist Proceedings, *In re* New York Stock Exchange LLC, Exchange Act Release No. 67857 (Sept. 14, 2012) (discussing the various propriety informational feeds of the New York Stock Exchange); Scott Patterson, *Speed Traders Get an Edge*, WALL ST. J. (Feb. 6, 2014, 8:49 PM), <http://online.wsj.com/articles/SB10001424052702304450904579367050946606562> [https://perma.cc/GTP7-77E4].

<sup>64</sup> LEWIS, *supra* note 8, at 180–85.

<sup>65</sup> *Id.*

<sup>66</sup> *Id.* at 52.

<sup>67</sup> *Id.* at 171.

<sup>68</sup> *See id.* (“[T]hough they made only half of all trades in the U.S. stock market, they submitted more than 99 percent of the orders.”).

<sup>69</sup> *Id.* at 111.

<sup>70</sup> *Id.* at 180–85.

most public, most democratic, financial market had become, in spirit, something more like a private viewing of a stolen work of art.”<sup>71</sup>

### 3. *The Heroes*

If high frequency traders are the villains of the story, then the heroes were an unlikely group of misfits led by a Canadian banker named Brad Katsuyama. The book chronicles how this group of men uncovered the manipulative mechanizations of high-frequency traders, and how they sought to upend the unfairness in the marketplace.

Katsuyama was a trader at the Royal Bank of Canada, a Canadian investment bank not thought to be a premier institution in the world of high finance.<sup>72</sup> Around 2007, Katsuyama began to see that his stock orders could not be completed at their requested volume and price specifications. For example, an order for 10,000 shares of Intel at \$22 a share, which appeared to be available on the market, would promptly disappear the moment he entered his trade.<sup>73</sup> It was as if the marketplace knew his desires before he declared them. Katsuyama decided to investigate, and discovered that other sophisticated traders on Wall Street were facing the same issue.

Along with his colleagues, Rob Park and Ronan Ryan, two unlikely Wall Street characters, Katsuyama decided to burrow further into the inner-workings of the U.S. stock market in order to gain a better understanding. Through careful trial and error, Katsuyama, Park, and Ryan discovered that an infinitesimally small measure of time—microseconds or millionths of a second—was at the crux of their trading issues.<sup>74</sup> They discovered that high-frequency trading firms were buying advantages in speed and access to manipulate the playing field in their favor. These firms did so via special access to co-located servers, high-speed cable lines, and customer order flows, which gave them more information and better execution times than everyone else in the marketplace.<sup>75</sup> It essentially meant that high-frequency firms could always have better, actionable information than other investors, and they could always execute their trades faster than other investors. It was akin to a patron at a restaurant seeing that you ordered a \$10 burger with your waiter, running ahead of your waiter with their

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<sup>71</sup> *Id.* at 69.

<sup>72</sup> *Id.* at 23.

<sup>73</sup> *Id.* at 30.

<sup>74</sup> *Id.* at 49.

<sup>75</sup> *Id.* at 60–64.

strategically placed speedy, automated waiter, and buying all the \$10 burgers so that you cannot complete your desired order unless you buy one at a premium.

Upon uncovering this disturbing discovery, Katsuyama sought to challenge the high-frequency firms. Counterintuitively, rather than trying to gain more speed in trading, Katsuyama and his team decided to reduce the speed of their trades. They built a program called Thor that would delay their order transmissions so that their orders would hit the servers of the various exchanges simultaneously.<sup>76</sup> By slowing their orders this way, it ensured that high-frequency firms could not see their order on one exchange and beat them to completing that order on another exchange using their superior speeds.<sup>77</sup> Thor was an effective countermeasure to the predatory practices of high-frequency traders, but its impact was limited in a modern marketplace dominated by high frequency trading.

To enhance their impact, Katsuyama and his team decided to leave their comfortable and lucrative jobs to start their own exchange, the Investors Exchange, or IEX.<sup>78</sup> IEX would not permit co-location, special data access, or rebates for orders, and it would charge one rate for all buyers and sellers.<sup>79</sup> IEX was designed to treat all investors equally and safeguard investors from the predatory practices of high-frequency traders.

#### 4. *The Fallout*

While others have previously written about high frequency trading and market manipulation,<sup>80</sup> none have generated the publicity and policy impact of *Flash Boys*.<sup>81</sup> Following its publication, private litigants, the New York Attorney General, the DOJ, the U.S. Senate, and the SEC all announced initiatives and

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<sup>76</sup> *Id.* at 50.

<sup>77</sup> *Id.* at 49.

<sup>78</sup> *Id.* at 164.

<sup>79</sup> *Id.* at 173–77.

<sup>80</sup> See SAL ARNUK & JOSEPH SALUZZI, *BROKEN MARKETS: HOW HIGH FREQUENCY TRADING AND PREDATORY PRACTICES ON WALL STREET ARE DESTROYING INVESTOR CONFIDENCE AND YOUR PORTFOLIO* 68–78 (2012); PATTERSON, *supra* note 2, at 233–78.

<sup>81</sup> *The New York Times Best Sellers*, N.Y. TIMES (May 11, 2014), <https://www.nytimes.com/books/best-sellers/2014/05/11/> [<https://perma.cc/UDF6-UTFF>]. The book, like many of Lewis's previous books, became a national bestseller. *About the Author*, MICHAEL LEWIS, <http://michaellewiswrites.com/index.html#top> (last visited Mar. 30, 2017); see also MICHAEL LEWIS, *LIAR'S POKER: RISING THROUGH THE WRECKAGE ON WALL STREET* (1989); MICHAEL LEWIS, *MONEYBALL: THE ART OF WINNING AN UNFAIR GAME* (2003); MICHAEL LEWIS, *THE BIG SHORT: INSIDE THE DOOMSDAY MACHINE* (2010); MICHAEL LEWIS, *THE BLIND SIDE: EVOLUTION OF A GAME* (2006).

actions to look into trading practices in the U.S. stock market.<sup>82</sup> Despite its publicity and policy impact, *Flash Boys* was not without its critics. Many observers inside and outside the financial industry thought that *Flash Boys* oversimplified the modern marketplace and unfairly vilified high-frequency traders.<sup>83</sup> The debate between the book's critics and its admirers is a legitimate debate about the book itself, but it is also part of a larger debate about the inner workings of the emerging, new financial reality.

## II. THE NEW FINANCIAL REALITY

The Flash Crash and *Flash Boys* serve as two flashpoints in recent history about a larger sea change occurring in our financial markets. Innovations and advances in financial technology have brought forth a new financial reality for market participants and regulators alike. The new methods of market manipulation alluded to in the Flash Crash and *Flash Boys* can be best understood in a wider context of the larger legal and policy issues surrounding innovation, governance, and operations of the new financial marketplace and the early regulatory responses to it.

### A. *The New Marketplace*

The Flash Crash and *Flash Boys* are part of a larger story about the rise of artificial intelligence, automation, and other forms of advanced technology used in finance. Underappreciated in the discussions surrounding the Flash Crash and *Flash Boys* is the fact that smart, autonomous high-speed machines running on algorithmic programs have gradually taken over many aspects of the financial industry beyond equity trading in our financial markets.<sup>84</sup> While the fallout of

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<sup>82</sup> See, e.g., *High Frequency Trading's Impact on the Economy: Hearing Before the Subcomm. on Sec., Ins., and Inv. of the H. Comm. on Banking, Hous., and Urban Affairs*, 113th Cong. 3 (2014) [hereinafter *Hearings*]; Michael Mackenzie, Kara Scannell & Nicole Bullock, *Share Trades: Murky Pools*, FIN. TIMES (June 27, 2014, 6:42 PM), <https://www.ft.com/content/a22603e4-fde1-11e3-acf8-00144feab7de> [<https://perma.cc/AH53-T4RG>]; Scott Patterson & Jenny Strasburg, *High-Speed Trading Firms Face New U.S. Scrutiny*, WALL ST. J. (Mar. 18, 2014, 8:27 PM), <https://www.wsj.com/articles/SB10001424052702303287804579447610625554506> [<https://perma.cc/DY2W-6FSB>]; Mary Jo White, Chair, Sec. & Exch. Comm'n, Address at the Sandler O'Neill & Partners, L.P. Global Exchange and Brokerage Conference: Enhancing Our Equity Market Structure (June 5, 2014), [http://www.sec.gov/News/Speech/Detail/Speech/1370542004312#\\_U\\_Ju28ZP8pF](http://www.sec.gov/News/Speech/Detail/Speech/1370542004312#_U_Ju28ZP8pF).

<sup>83</sup> See, e.g., Michael J. de la Merced & William Alden, *Scrutiny for Wall Street's Warp Speed*, N.Y. TIMES (Mar. 31, 2014, 9:30 PM), <https://dealbook.nytimes.com/2014/03/31/scrutiny-for-wall-streets-warp-speed/> [<https://perma.cc/X6E7-AHB8>] (quoting several critics of the book); *Hearings*, *supra* note 82 (statement of Hal S. Scott, Director, Comm. on Capital Markets Regulation).

<sup>84</sup> See Tom C.W. Lin, *National Pastime(s)*, 55 B.C. L. REV. 1197, 1207–09 (2014) (discussing the rise of smart machines in the financial industry); Salmon & Stokes, *supra* note 54 (“Algorithms have become so

the Flash Crash and *Flash Boys* has centered on the vices of new financial technology in terms of high-frequency and algorithmic trading programs, the larger, still-unfolding context of the new financial reality offers a more balanced and complicated picture of the ongoing transformation in the financial industry.

Over the last two decades, advances in information technology and financial regulation have led to a transformational shift in the nature and operations of the financial industry.<sup>85</sup> Human effort and human analysis have gradually been supplanted by computerized automation and artificial intelligence, creating an industry where the machines have become just as important as the humans.<sup>86</sup> This transformation has essentially changed modern finance into what has been termed cyborg finance, an industry where machines and humans share operational influence and power.<sup>87</sup>

The transformation of modern finance into cyborg finance touches almost every part of the financial industry.<sup>88</sup> While trading has received most of the attention because of the Flash Crash and *Flash Boys*, other basic functions of finance, such as risk analysis and wealth management, have also been transformed by the rise of autonomous smart machines in the financial industry.<sup>89</sup> Today, practically every significant financial institution uses some form of advanced artificial intelligence for risk analysis and investment

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ingrained in our financial system that the markets could not operate without them.”); Gregory Scopino, *Do Automated Trading Systems Dream of Manipulating the Price of Futures Contracts? Policing Markets for Improper Trading Practices by Algorithmic Robots*, 67 FLA. L. REV. 221, 222–24 (2015) (“Now, almost all parts of the financial markets, including the markets for futures and other derivatives, are computerized and automated to some extent, from the exchanges to the traders.”).

<sup>85</sup> See, e.g., Robert DeYoung, *Safety, Soundness, and the Evolution of the U.S. Banking Industry*, 92 FED. RES. BANK OF ATLANTA ECON. REV., First and Second Quarters 2007, at 41, 42–44; Loretta J. Mester, *Commentary: Some Thoughts on the Evolution of the Banking System and the Process of Financial Intermediation*, 92 FED. RES. BANK OF ATLANTA ECON. REV., First and Second Quarters 2007, at 67, 67–72; Arthur E. Wilmarth, Jr., *The Transformation of the U.S. Financial Services Industry, 1975–2000: Competition, Consolidation, and Increased Risks*, 2002 U. ILL. L. REV. 215.

<sup>86</sup> See, e.g., Concept Release on Risk Controls and System Safeguards for Automated Trading Environments, 78 Fed. Reg. 56,542, 56,573 app. 2 (Sept. 12, 2013) (“We have witnessed a fundamental shift in markets from human-based trading to highly automated electronic trading.”).

<sup>87</sup> See Tom C.W. Lin, *The New Investor*, 60 UCLA L. REV. 678, 681–82 (2013) (introducing the concept of cyborg finance).

<sup>88</sup> See FIN. CRISIS INQUIRY COMM’N, THE FINANCIAL CRISIS INQUIRY REPORT: FINAL REPORT OF THE NATIONAL COMMISSION ON THE CAUSES OF THE FINANCIAL AND ECONOMIC CRISIS IN THE UNITED STATES, at xvii, 44, 58 (2011) [hereinafter FINANCIAL CRISIS INQUIRY REPORT] (discussing the rising importance of financial technology); PATTERSON, *supra* note 2, at 36–38 (chronicling the growth of supercomputers in the financial industry).

<sup>89</sup> See Timothy Lavin, *Monsters in the Market*, THE ATLANTIC (July/August 2010), <https://www.theatlantic.com/magazine/archive/2010/07/monsters-in-the-market/308122/> [<https://perma.cc/AD3G-4RPQ>].

management, two financial tasks that were previously done principally by humans.<sup>90</sup> Hedge funds use autonomous algorithmic software to read newsfeeds, analyze data, and pick stocks to generate consistent positive returns.<sup>91</sup> BlackRock, the world's largest asset management company, uses a proprietary artificial intelligence program, called Aladdin, to manage risk and allocate investments on behalf of its institutional clients.<sup>92</sup> During the financial crisis of 2008, BlackRock, using Aladdin, assisted the federal government with its critical and thorny decisions relating to the bailouts of distressed firms like AIG, Bear Stearns, and Citigroup.<sup>93</sup> More recently, startup companies like Wealthfront and Betterment use algorithmic programs exclusively to manage the assets of investors, completely foregoing the traditional model of financial advisors.<sup>94</sup> Even the staid, clubby corporate bond market is being disrupted by new financial technology as automated trading platforms have started to replace bond traders and bond desks.<sup>95</sup> In sum, this technological transformation of the financial industry has rendered many established financial companies ostensibly high-tech companies. Furthermore, some of the most promising and exciting upstarts in the financial industry are dubbed "FinTech" firms because they are using technology in innovative ways to challenge and change traditional financial practices.<sup>96</sup>

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<sup>90</sup> Gerding, *supra* note 7, at 130–35.

<sup>91</sup> See, e.g., PATTERSON, *supra* note 2, at 322–23; Bradley Hope, *How Computers Trawl a Sea of Data for Stock Picks*, WALL ST. J. (Apr. 1, 2015, 10:30 PM), <http://www.wsj.com/articles/how-computers-rawl-a-sea-of-data-for-stock-picks-1427941801> [<https://perma.cc/JF4K-YWJV>]; Seth Stevenson, *The Wolf of Wall Tweet*, SLATE (Apr. 20, 2015, 4:12 PM), [http://www.slate.com/articles/business/moneybox/2015/04/bot\\_makes\\_2\\_4\\_million\\_reading\\_twitter\\_meet\\_the\\_guy\\_it\\_cost\\_a\\_fortune.html?wpsrc=fol\\_tw](http://www.slate.com/articles/business/moneybox/2015/04/bot_makes_2_4_million_reading_twitter_meet_the_guy_it_cost_a_fortune.html?wpsrc=fol_tw) [<https://perma.cc/9SCR-8HXX>].

<sup>92</sup> See Sheelah Kolhatkar & Sree Vidya Bhaktavatsalam, *The Colossus of Wall Street*, BLOOMBERG (Dec. 9, 2010, 5:00 PM), <https://www.bloomberg.com/news/articles/2010-12-09/the-colossus-of-wall-street> [<https://perma.cc/2M2F-UD93>].

<sup>93</sup> *Id.*

<sup>94</sup> John F. Wasik, *Sites to Manage Personal Wealth Gaining Ground*, N.Y. TIMES (Feb. 10, 2014), [https://www.nytimes.com/2014/02/11/your-money/sites-to-manage-personal-wealth-gaining-ground.html?\\_r=0](https://www.nytimes.com/2014/02/11/your-money/sites-to-manage-personal-wealth-gaining-ground.html?_r=0) [<https://perma.cc/HR3Q-L2QB>].

<sup>95</sup> See Nathaniel Popper, *Shouts on Bond-Trading Floor Yield to Robot Beeps*, N.Y. TIMES (Oct. 19, 2014, 8:09 PM), <https://dealbook.nytimes.com/2014/10/19/shouts-on-bond-trading-floor-yield-to-robot-beeps/> [<https://perma.cc/FX82-R9Y5>]; Shawn Tully, *The Man Behind the \$7.7 Trillion Bond Revolution*, FORTUNE (Dec. 4, 2014), <http://fortune.com/2014/12/04/marketaxess-holdings-ceo-rick-mcvey/> [<https://perma.cc/BY64-BB6K>].

<sup>96</sup> See Andrew Ross Sorkin, *Fintech Firms Are Taking On the Big Banks, but Can They Win?*, N.Y. TIMES (Apr. 6, 2016), <https://www.nytimes.com/2016/04/07/business/dealbook/fintech-firms-are-taking-on-the-big-banks-but-can-they-win.html?rref=collection%2Fspotlightcollection%2Fdealbook-special-section> [<https://perma.cc/QJR6-9R5E>].

The emergence of this new, technologically advanced financial reality contains both virtues and vices. In terms of virtues, new financial technology has expanded the capital markets, decreased transactional costs, lowered the cost of capital for businesses, and provided convenient new tools for investors and consumers.<sup>97</sup> For instance, while high-frequency trading can present serious drawbacks, it has also, in many instances, increased liquidity, accelerated execution speeds, narrowed price spreads, and lowered transaction costs for investors.<sup>98</sup> Transactions that previously required hours of labor and hundreds and thousands of dollars in commissions to a broker can now be executed in seconds for a few dollars from one's phone with a few taps. In 2017, it was reported that currency traders were using smartphone apps to make \$100 million trades.<sup>99</sup>

In terms of vices, the new financial marketplace's heavy emphasis on speed, connectivity, and technology presented new interlocking risks for market participants related to speed, connectivity, and complexity. First, analogous to how the growing size of financial institutions gave rise to the systemic risk of "too big to fail,"<sup>100</sup> the growing emphasis on faster financial speed has created the systemic risk of "too fast to save."<sup>101</sup> As evidenced by the Flash Crash and *Flash Boys*, financial transactions occur at incredibly high velocities measured in milliseconds. While the accelerating speed of finance has systemic benefits, it also increases the likelihood that inadvertent errors, malicious acts, and technological disruptions would harm the financial institutions and the financial

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<sup>97</sup> See, e.g., Korsmo, *supra* note 7, at 549–50 (cataloguing benefits relating to high-frequency trading); Donald C. Langevoort & Robert B. Thompson, "Publicness" in *Contemporary Securities Regulation After the JOBS Act*, 101 GEO. L.J. 337, 347 (2013) ("Today, liquidity is now much more possible outside of traditional exchanges. In the new millennium, cheap information and low communication costs have expanded markets . . .").

<sup>98</sup> See, e.g., FRANK PARTNOY, WAIT: THE ART AND SCIENCE OF DELAY 43 (2012) (discussing how high-frequency trading improves liquidity); Jonathan Brogaard, Terrence Hendershott & Ryan Riordan, *High-Frequency Trading and Price Discovery*, 27 REV. FIN. STUD. 2267, 2267 (2014) (highlighting how high-frequency trading improves price discovery); Joel Hasbrouck & Gideon Saar, *Low-Latency Trading*, 16 J. FIN. MKTS. 646, 648 (2013) (suggesting that high-frequency trading has stabilizing marketplace effects); Korsmo, *supra* note 7, at 549–50 (noting various benefits of high-frequency trading).

<sup>99</sup> Emily Glazer, *Behind J.P. Morgan's \$100 Million Cell Phone Trade*, WALL ST. J. (Apr. 5, 2017), <https://blogs.wsj.com/moneybeat/2017/04/05/behind-j-p-morgans-100-million-cell-phone-trade/> [<https://perma.cc/3GT3-TREL>].

<sup>100</sup> See S. PERMANENT SUBCOMM. ON INVESTIGATIONS, WALL STREET AND THE FINANCIAL CRISIS: ANATOMY OF A FINANCIAL COLLAPSE 15–17 (2011) (reporting on the regulatory challenges of "too big to fail"); ANDREW ROSS SORKIN, TOO BIG TO FAIL: THE INSIDE STORY OF HOW WALL STREET AND WASHINGTON FOUGHT TO SAVE THE FINANCIAL SYSTEM FROM CRISIS—AND THEMSELVES 538–39 (2009) (discussing the systemic risk of "too big to fail" institutions).

<sup>101</sup> See Lin, *supra* note 87, at 711–14 (introducing the concept of "too fast to save").

system before anyone can stop it.<sup>102</sup> During periods of financial tumult and distress, automated programs can exacerbate volatility and reduce liquidity by rapidly eliminating trading positions in the marketplace.<sup>103</sup> The emphasis on speed has also meant that institutional safeguards have been sacrificed for higher velocities, rendering it even more difficult to prevent institutional and systemic harms.<sup>104</sup> In the contemporary high-speed, automated marketplace, a misinformed trader, a malicious actor, or a programming error can cause significant institutional harm as well as systemic damage much more easily. For instance, in 2008, a rogue trader nearly destroyed the prominent French investment bank, Société Générale, with \$69 billion in unauthorized positions over a period of several months.<sup>105</sup> Three years later, in 2011, another trader at UBS, a leading Swiss investment bank, caused losses of \$2.3 billion.<sup>106</sup> In 2014, the market for U.S. Treasuries experienced a 37-basis point swing during a few minutes, one of the largest changes in one session ever, for no apparent reason.<sup>107</sup> While such volatility and losses may have been possible in other eras, the financial velocity of today's marketplace made such bad acts more impactful and more difficult to prevent.

Second, the new financial reality's heavy emphasis on connectivity has created the systemic risk of "too linked to fail."<sup>108</sup> In the new financial marketplace, institutions, industries, and instruments are all intermediated and interconnected like never before in a single high-tech financial network.<sup>109</sup>

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<sup>102</sup> See Floyd Norris, *In Markets' Tuned-Up Machinery, Stubborn Ghosts Remain*, N.Y. TIMES (Aug. 22, 2013, 8:38 PM), <https://dealbook.nytimes.com/2013/08/22/in-markets-tuned-up-machinery-stubborn-ghosts-remain/> [<https://perma.cc/C67P-FLPE>]; see also Haldane, *supra* note 16 ("For the first time in financial history, machines can execute trades far faster than humans can intervene."); Andrei A. Kirilenko & Andrew W. Lo, *Moore's Law Versus Murphy's Law: Algorithmic Trading and Its Discontents*, 27 J. ECON. PERSPS., Spring 2013, at 51, 60 ("[A]utomated trading systems provide enormous economies of scale and scope in managing large portfolios, but trading errors can now accumulate losses at the speed of light before they're discovered and corrected by human oversight.").

<sup>103</sup> PARTNOY, *supra* note 98, at 43.

<sup>104</sup> Frank J. Fabozzi, Sergio M. Focardi & Caroline Jonas, *High-Frequency Trading: Methodologies and Market Impact*, 19 REV. FUTURES MKTS. 7, 11 (2011).

<sup>105</sup> Nicola Clark, *Rogue Trader at Société Générale Gets 3 Years*, N.Y. TIMES (Oct. 5, 2010), <http://www.nytimes.com/2010/10/06/business/global/06bank.html> [<https://perma.cc/FB3L-G9RV>].

<sup>106</sup> Julia Werdigier, *UBS Says Trading Losses Were Closer to \$2.3 Billion*, N.Y. TIMES (Sept. 18, 2011), <http://www.nytimes.com/2011/09/19/business/global/ubs-says-trading-losses-closer-to-2-3-billion.html> [<https://perma.cc/AVP2-Q2BX>].

<sup>107</sup> U.S. DEP'T OF TREASURY ET AL., JOINT STAFF REPORT: THE U.S. TREASURY MARKET ON OCTOBER 15, 2014 (2015), [http://www.treasury.gov/press-center/press-releases/Documents/Joint\\_Staff\\_Report\\_Treasury\\_10-15-2015.pdf](http://www.treasury.gov/press-center/press-releases/Documents/Joint_Staff_Report_Treasury_10-15-2015.pdf).

<sup>108</sup> See Lin, *supra* note 87, at 714–16 (introducing the concept of "too linked to fail").

<sup>109</sup> See Markus K. Brunnermeier, *Deciphering the Liquidity and Credit Crunch 2007–2008*, 23 J. ECON. PERSPS., Winter 2009, at 77, 96–97 (discussing the financial system's "interwoven network of financial

Distinct from “too big to fail,” this emerging systemic risk of “too linked to fail” includes smaller participants and products, whose actions and failures may ripple across the system because of their connectivity regardless of their individual value or size.<sup>110</sup> A further complication is the fact that many interconnected financial participants in the new marketplace engage in similar and interdependent strategies.<sup>111</sup> As a result, the failing or flaw of one participant could not only adversely impact others, but could also create vicious cycles of volatility for the entire financial system as trades cascade and generate feedback loops and spillover effects of serious consequences.<sup>112</sup> Waddell & Reed, for instance, is not a systemically important financial institution, yet because of the connectivity of the new financial marketplace, a single trade from that firm served as an important catalyst in the Flash Crash, which at one point generated a trillion dollars in losses.<sup>113</sup>

Third, the new financial reality’s heavy reliance on complex technological systems also poses new risks beyond those associated with speed and connectivity. Complex, technological systems like the ones driving our financial markets are inherently prone to accidents, as described by Charles Perrow in his seminal study on the risks of technology, *Normal Accidents*.<sup>114</sup> As such, “normal financial accidents” will become more common as the financial markets grow more reliant on complex, high-tech systems.<sup>115</sup> In the last few years, both the New York Stock Exchange and the NASDAQ experienced serious technical

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obligations”); Robin Greenwood & David S. Scharfstein, *How to Make Finance Work*, HARV. BUS. REV. (Mar. 2012), <https://hbr.org/2012/03/how-to-make-finance-work>; HAL S. SCOTT, COMM. ON CAPITAL MKTS. REGULATION, INTERCONNECTEDNESS AND CONTAGION (2012), [http://www.aei.org/files/2013/01/08/-interconnectedness-and-contagion-by-hal-scott\\_153927406281.pdf](http://www.aei.org/files/2013/01/08/-interconnectedness-and-contagion-by-hal-scott_153927406281.pdf).

<sup>110</sup> See, e.g., Steven L. Schwarcz, *Systemic Risk*, 97 GEO. L.J. 193, 200 (2008) (discussing the systemic risks caused by financial intermediation and disintermediation).

<sup>111</sup> Concept Release on Equity Market Structure, Exchange Act Release No. 34-61358, 75 Fed. Reg. 3594, 3611 (Jan. 21, 2010) (codified at 17 C.F.R. pt. 242) (“[M]any proprietary firms potentially could engage in similar or connected trading strategies that, if such strategies generated significant losses at the same time, could cause many proprietary firms to become financially distressed and lead to large fluctuations in market prices.”); Bernard S. Donefer, *Algos Gone Wild: Risk in the World of Automated Trading Strategies*, 5 J. TRADING, Spring 2010, at 31, 31.

<sup>112</sup> See BROWN, *supra* note 57, at 7; PATTERSON, *supra* note 2, at 9–10 (discussing the financial dangers of “a vicious self-reinforcing feedback loop”); Louise Story & Graham Bowley, *Market Swings Are Becoming New Standard*, N.Y. TIMES (Sept. 11, 2011), <http://www.nytimes.com/2011/09/12/business/economy/stock-markets-sharp-swings-grow-more-frequent.html> [<https://perma.cc/TX93-NLRX>]; Surowiecki, *supra* note 46 (“High-speed firms tend to mimic one another’s trading strategies, and in times of crisis this can amplify price swings.”).

<sup>113</sup> See *supra* Part I.A.1.

<sup>114</sup> See CHARLES PERROW, *NORMAL ACCIDENTS: LIVING WITH HIGH-RISK TECHNOLOGIES* 4–5 (1999).

<sup>115</sup> Marc Schneiberg & Tim Bartley, *Regulating or Redesigning Finance? Market Architectures, Normal Accidents, and Dilemmas of Regulatory Reform*, in *MARKETS ON TRIAL: THE ECONOMIC SOCIOLOGY OF THE FINANCIAL CRISIS: PART A* 281, 284–89 (Michael Lounsbury & Paul M. Hirsch eds., 2010).

glitches that halted trading for several hours during otherwise normal trading days.<sup>116</sup> Furthermore, the new financial reality's heavy reliance on technology exposes the marketplace to new forms of misconduct, malfeasance, and manipulation that were technologically impossible in previous eras.<sup>117</sup> For example, in the last few years alone, hacked social media accounts and false data entered into the SEC's EDGAR electronic filing system have been used to manipulate the stock market in the United States.<sup>118</sup> In 2016, Federal Reserve Chairwoman Janet Yellen testified before Congress that cyberattacks on the financial industry represent "one of the most significant risk our country faces."<sup>119</sup>

In sum, the events of the Flash Crash and the story told in *Flash Boys* are part of a larger, unfolding narrative about the rise of artificial intelligence, automation, and other forms of technology in the new financial marketplace. As entrepreneurs and technologists continue to push for faster speeds, greater connectivity, and better technology, the financial marketplace will gain numerous benefits as well as face a multitude of dangers, including new systemic risks and new forms of market manipulation.<sup>120</sup>

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<sup>116</sup> See E.S. Browning & Scott Patterson, *Market Size + Complex Systems = More Glitches*, WALL ST. J. (Aug. 22, 2013, 10:49 PM), <https://www.wsj.com/articles/SB10001424127887323980604579029342001534148> [<https://perma.cc/EC6K-JCSQ>]; Nathaniel Popper, *Pricing Problem Suspends NASDAQ for Three Hours*, N.Y. TIMES (Aug. 22, 2013, 12:52 PM), <https://dealbook.nytimes.com/2013/08/22/nasdaq-market-halts-trading/> [<https://perma.cc/5MAK-JHN3>]; Nathaniel Popper, *The Stock Market Bell Rings, Computers Fail, Wall Street Cringes*, N.Y. TIMES (July 8, 2015), <https://www.nytimes.com/2015/07/09/business/dealbook/new-york-stock-exchange-suspends-trading.html> [<https://perma.cc/D734-NEZ3>].

<sup>117</sup> See, e.g., Chiara Albanese, Daniele Lepido & Giles Turner, *'Anonymous' Joins Hacker Army Targeting Central Banks for Cash*, BLOOMBERG (Mar. 17, 2017, 4:33 AM), <https://www.bloomberg.com/news/articles/2017-03-17/-anonymous-joins-hacker-army-targeting-central-banks-for-cash> [<https://perma.cc/Q6K4-46SZ>].

<sup>118</sup> See, e.g., Chozick & Perlroth, *supra* note 48; Goldstein, *supra* note 3.

<sup>119</sup> Albanese, *supra* note 117.

<sup>120</sup> See, e.g., Concept Release on Equity Market Structure, Exchange Act Release No. 34-61358, 75 Fed. Reg. 3594, 3609-10 (Jan. 21, 2010) (codified at 17 C.F.R. pt. 242) (highlighting the accelerating velocity of the financial marketplace); A. D. Wissner-Gross & C. E. Freer, *Relativistic Statistical Arbitrage*, 82 PHYSICAL REV. 056104-1, 056104-1 to -2 (2010) (studying trading arbitrage near the speed of light); Graham Bowley, *The New Speed of Money, Reshaping Markets*, N.Y. TIMES (Jan. 1, 2011), <http://www.nytimes.com/2011/01/02/business/02speed.html> [<https://perma.cc/P7E3-W379>] (reporting on the unprecedented race for faster financial trading speeds); Quentin Hardy, *A Strange Computer Promises Great Speed*, N.Y. TIMES (Mar. 21, 2013), <http://www.nytimes.com/2013/03/22/technology/testing-a-new-class-of-speedy-computer.html> [<https://perma.cc/9HP4-UBW9>]; Jesse Westbrook & Sam Mamudi, *Wall Street Buys NATO Microwave Towers in Quest for Speed*, BLOOMBERG (July 16, 2014, 2:49 PM), <https://www.bloomberg.com/news/articles/2014-07-15/wall-street-grabs-nato-towers-in-traders-speed-of-light-quest> [<https://perma.cc/J7EN-KCJW>].

### B. *The Early Regulatory Response*

Policymakers and regulators have recognized the structural changes afoot within the financial marketplace and have begun responding to these fundamental changes.<sup>121</sup> One of the chief tasks for policymakers and regulators in coming years centers on how best to upgrade a twentieth-century financial infrastructure for the financial innovations of the twenty-first century, like high-frequency trading and algorithmic wealth management. Policymakers need to ensure that the financial infrastructure is secure, stable, and sustainable in light of the unfolding developments in the marketplace. This responsibility is akin to making certain that a transportation system built for a world of horse-drawn carriages is safe, stable, and sustainable for a world of high-speed, self-driven cars. The early regulatory responses to the new unfolding financial reality of the marketplace suggest that policymakers and regulators will likely enhance their own technological capabilities, carefully target critical components in the marketplace, and leverage market-oriented modes of regulation as means to better govern the new financial marketplace.

Following the Flash Crash and years prior to the publication of *Flash Boys*, policymakers and regulators, like those at the SEC, had already been focused on the integrity of the financial markets in light of new technology, and they continued with a renewed focus after the outcry that followed the book's publication. Policymakers and regulators have focused on enhancing their own technological capabilities to better govern the marketplace. In recent years, the SEC developed more quantitative and technological capabilities and initiatives, such as the Center for Risk and Quantitative Analytics, the National Exam Analytics Tool (NEAT), and the Market Information Data Analytics System (MIDAS), to keep up with the changing marketplace.<sup>122</sup> Additionally, in 2014, the SEC adopted Regulation Systems Compliance and Integrity (Regulation SCI) to update the regulatory framework for a marketplace that is more

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<sup>121</sup> See, e.g., Concept Release on Risk Controls and System Safeguards for Automated Trading Environments, 78 Fed. Reg. 56,542, 56,546–48 (Sept. 12, 2013).

<sup>122</sup> See Scott Patterson, *Meet the SEC's Brainy New Crime Fighters*, WALL ST. J. (Dec. 14, 2014, 10:39 PM), <http://www.wsj.com/articles/meet-the-secs-brainy-new-crime-fighters-1418601581> [<https://perma.cc/U5K6-CTJK>]; Press Release, U.S. Sec. & Exch. Comm'n, SEC Announces Enforcement Initiatives to Combat Financial Reporting and Microcap Fraud and Enhance Risk Analysis (July 2, 2013), <http://www.sec.gov/News/PressRelease/Detail/PressRelease/1365171624975#.VJm7DEAQE>; Mary Jo White, Chair, U.S. Sec. & Exch. Comm'n, Speech at the 41st Annual Securities Regulation Institute: The SEC in 2014 (Jan. 27, 2014), <http://www.sec.gov/News/Speech/Detail/Speech/1370540677500#UvUmcPldV8E>.

fragmented and technologically driven by disparate electronic systems.<sup>123</sup> Regulation SCI builds on Regulation Alternative Trading System and Regulation National Market System, the two bodies of rules from the past decade that ushered in today's electronically driven marketplace.<sup>124</sup> Following the *Flash Boys* fallout, the SEC and others have continued to develop safeguards and rules for the new financial marketplace with a renewed effort.<sup>125</sup> There have been proposals and implementations of mechanisms, such as new circuit breakers and kill switches, to guard against the accelerating velocities and volatilities of the marketplace.<sup>126</sup> There have also been proposals and implementations of mechanisms like tick-size experimentation and consolidated audit trails that would provide more information to regulators about the activities taking place in dark pools and other alternative trading platforms.<sup>127</sup>

In setting forth new rules and regulations, policymakers will likely shift from a traditional, omnibus, government-oriented mode of financial regulation towards a more targeted, market-oriented mode of regulation, given the diversity of participants and platforms in the modern marketplace. This shift in regulatory posture could yield a number of significant benefits for the marketplace. First, targeted regulation would help reduce some of the harmful, unintended consequences that accompany one-size-fits-all, omnibus regulation.<sup>128</sup> The days of a few dominant public exchanges have given way to an era of numerous public and private trading platforms linked together by complex communication networks; thus, one top-down body of regulation would likely be too blunt for today's diverse financial ecosystem. Targeted rules for distinct participants and platforms would be more appropriate in this environment. Early actions from

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<sup>123</sup> Regulation Systems Compliance and Integrity, Exchange Act Release No. 34-73639, 79 Fed. Reg. 72,252, 72,252 (Dec. 5, 2014) (codified at 17 C.F.R. pts. 240, 242, 249).

<sup>124</sup> See 17 C.F.R. § 242.300(a) (2017); 17 C.F.R. § 242.601; see also Lin, *supra* note 7, at 572–73 (describing how these two regulations helped facilitate modern financial innovations over the last decade).

<sup>125</sup> See, e.g., White, *supra* note 82.

<sup>126</sup> See Luis A. Aguilar, Comm'r, Sec. & Exch. Comm'n, Speech at Practicing Law Institute's SEC Speaks in 2013 Program: Addressing Market Instability Through Informed and Smart Regulation (Feb. 22, 2013), [https://www.sec.gov/News/Speech/Detail/Speech/1365171492386#U\\_OoCMZP8pE](https://www.sec.gov/News/Speech/Detail/Speech/1365171492386#U_OoCMZP8pE); *Investor Bulletin: Measures to Address Market Volatility*, SEC. & EXCHANGE COMMISSION, <http://www.sec.gov/investor/alerts/circuitbreakersbulletin.htm> (last visited Jan. 31, 2017).

<sup>127</sup> See 17 C.F.R. § 242.613; Press Release, Sec. & Exch. Comm'n, SEC Approves Pilot to Assess Tick Size Impact for Smaller Companies (May 6, 2015), <https://www.sec.gov/news/pressrelease/2015-82.html>.

<sup>128</sup> See J.B. Ruhl & James Salzman, *Mozart and the Red Queen: The Problem of Regulatory Accretion in the Administrative State*, 91 GEO. L.J. 757, 814 (2003) ("The unintended consequences of a rule thus emerge from the complex interactions between the full set of rules and the human behaviors they motivate."); Whitehead, *supra* note 7, at 1270 ("There is . . . a real risk that new rules will have unanticipated consequences, particularly in a system as complex as today's financial markets.").

policymakers and regulators suggest a move toward more targeted financial regulation. For instance, in 2015, the Financial Industry Regulatory Authority (FINRA) proposed a targeted amendment to its existing rules as a means to govern algorithmic trading, which the SEC subsequently approved in 2016.<sup>129</sup> Instead of seeking a sweeping rule in response to the rise of algorithmic trading, FINRA attempted to craft a carefully tailored rule that targeted certain critical parties in the industry.

Second, more market-oriented modes of regulation in many circumstances may be better suited than the traditional government-oriented mode of regulation to achieve the regulatory aims of policymakers in light of contemporary political considerations and the dynamism of financial innovation.<sup>130</sup> More market-oriented regulation that sensibly marshals public and private resources can break down some of the structural barriers of jurisdiction, origination, and resource scarcity faced by domestic and international government regulators.<sup>131</sup> Market-oriented regulation already plays an important role in financial regulation; therefore, the baseline question is not about instituting market-oriented regulation but is instead about how to do it better.<sup>132</sup> This suggestion for smart market-oriented regulation is not about deregulation but is instead about better matching the comparative advantages of government forces with the comparative advantages of market forces.<sup>133</sup> For instance, mindful of its lack of technical sophistication, the SEC enlisted private companies from the marketplace to help it establish its consolidated audit trail database of market information rather than building one through the government's bureaucracy.<sup>134</sup> In contrast to pure public regulation, which can be slow and blunt, market-

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<sup>129</sup> See *Regulatory Notice 15-06: Registration of Associated Person Who Develop Algorithmic Trading Strategies*, FIN. INDUS. REG. AUTH. (Mar. 2015), [http://www.finra.org/sites/default/files/notice\\_doc\\_file\\_ref/Notice\\_Regulatory\\_15-06.pdf](http://www.finra.org/sites/default/files/notice_doc_file_ref/Notice_Regulatory_15-06.pdf).

<sup>130</sup> Levitin, *supra* note 7, at 2068.

<sup>131</sup> See Lin, *supra* note 7, at 590–95 (discussing the limitations of public law in regulating modern finance).

<sup>132</sup> See William A. Birdthistle & M. Todd Henderson, *Becoming a Fifth Branch*, 99 CORNELL L. REV. 1, 12 (2013); Roberta S. Karmel, *Should Securities Industry Self-Regulatory Organizations Be Considered Government Agencies?*, 14 STAN. J.L. BUS. & FIN. 151, 151 (2008); Omarova, *supra* note 7, at 413.

<sup>133</sup> See, e.g., WILLIAM D. EGGERS & PAUL MACMILLAN, *THE SOLUTION REVOLUTION: HOW BUSINESS, GOVERNMENT, AND SOCIAL ENTERPRISES ARE TEAMING UP TO SOLVE SOCIETY'S TOUGHEST PROBLEMS* 3–16 (2013); MARIANA MAZZUCATO, *THE ENTREPRENEURIAL STATE: DEBUNKING PUBLIC VS. PRIVATE SECTOR MYTHS* 9–15 (2015); Leo E. Strine, Jr., *Our Continuing Struggle with the Idea That For-Profit Corporations Seek Profit*, 47 WAKE FOREST L. REV. 135, 136 (2012) (“In the end, policy makers should not delude themselves about the corporation’s ability to police itself; government still has a critical role in setting the rules of the game.”).

<sup>134</sup> Matthew Phillips & Silla Brush, *SEC Computer Called CAT Will Peer into Dark Pools, Track Orders*, BLOOMBERG (Aug. 7, 2014, 12:24 PM), <https://www.bloomberg.com/news/articles/2014-08-07/sec-computer-called-cat-will-peer-into-dark-pools-track-orders> [<https://perma.cc/3M27-Y8DN>].

oriented regulation, in some cases, can be more knowledgeable and more responsive to the practices of the rapidly changing marketplace.<sup>135</sup> More market-oriented regulation will likely also have the added benefit of encouraging experimentation and competition in the marketplace.<sup>136</sup> After all, it was Brad Katsuyama and his team, not government bureaucrats, who created a workable, competitive antidote to the ills of high-frequency trading and market manipulation through private experimentation.

In sum, the early regulatory response to the sea change in the marketplace suggests that policymakers and regulators will likely enhance their own technological capabilities, carefully target critical components in the marketplace, and leverage market-oriented modes of regulation as a means to better govern the new financial marketplace. While promising, the early regulatory response to the unfolding developments also suggests that much work still needs to be done to protect the integrity of the marketplace from emerging inherent systemic risks and new external methods of market manipulation.

### III. OLD AND NEW MARKET MANIPULATION

Market manipulation, broadly defined, has existed since the infancy of financial markets.<sup>137</sup> In the landmark securities case, *Santa Fe Industries v. Green*, the U.S. Supreme Court stated that market manipulation “refers generally to practices, such as wash sales, matched orders, or rigged prices, that are intended to mislead investors by artificially affecting market activity.”<sup>138</sup> Markets are populated by both upstanding participants and disreputable ones. This is true of the markets of the Rockefellers and the Great Depression, as well as of the markets of the Flash Crash and the *Flash Boys*.<sup>139</sup> Manipulated markets not only distort the prices and transactions in one marketplace, but they also have important implications for capital allocation, investments, and savings in other

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<sup>135</sup> See, e.g., Henry T.C. Hu, *Swaps, the Modern Process of Financial Innovation and the Vulnerability of a Regulatory Paradigm*, 138 U. PA. L. REV. 333, 412 (1989) (noting the lack of regulatory expertise in connection with some complex financial products).

<sup>136</sup> For a general discussion of regulatory and policy experimentation, see, e.g., JIM MANZI, UNCONTROLLED: THE SURPRISING PAYOFF OF TRIAL-AND-ERROR FOR BUSINESS, POLITICS, AND SOCIETY 209–11 (2012); Michael Abramowicz, Ian Ayres & Yair Listokin, *Randomizing Law*, 159 U. PA. L. REV. 929, 933–34 (2011); Zachary Gubler, *Experimental Rules*, 55 B.C. L. REV. 129, 136–37 (2014); Yair Listokin, *Learning Through Policy Variation*, 118 YALE L.J. 480, 483–84 (2008); Charles F. Sabel & William H. Simon, *Minimalism and Experimentalism in the Administrative State*, 100 GEO. L.J. 53, 60–61, 78 (2011).

<sup>137</sup> See JERRY W. MARKHAM, LAW ENFORCEMENT AND THE HISTORY OF FINANCIAL MARKET MANIPULATION 9–14 (2014) (chronicling various episodes of market manipulation throughout ancient history).

<sup>138</sup> 430 U.S. 462, 476 (1977).

<sup>139</sup> See MARKHAM, *supra* note 137, at xiii–xiv.

markets and the greater economy.<sup>140</sup> The modes of market manipulation are only limited by the imagination and deviousness of humans.<sup>141</sup> As financial markets evolve from human operations to electronic operations, the methods of market manipulation have evolved in kind, with old market manipulation giving way to new market manipulation.<sup>142</sup> To better understand the emerging methods of market manipulation, it may be instructive to highlight and compare some of the new methods with some of the common traditional methods of market manipulation.

### A. *Traditional Market Manipulation*

Traditional market manipulation is normally effectuated through human actors using distortive market power, deceit, misinformation, and illicit information in dealings with other human actors in the marketplace. Generally, the goal of traditional market manipulation is to distort the natural price of certain financial instruments or transactions to the benefit of the manipulative party.<sup>143</sup> These traditional attempts at market distortion can manifest in various forms. A few of the more common and prominent methods of traditional market manipulation include cornering, squeezing, front running, wash trading, pumping-and-dumping, and benchmark distortion.

#### 1. *Cornering and Squeezing*

Cornering and squeezing, which use market power to distort the prices of a financial instrument, are two of the oldest forms of market manipulation.<sup>144</sup> Cornering generally occurs when one or more parties acquire the total supply of

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<sup>140</sup> See, e.g., Fox, Glosten & Rauterberg, *supra* note 7, at 196 (“The performance of the equities market has important effects on the efficiency with which goods and services are produced in our economy and on the real economy’s rate of growth. Equities also play a vital role as a place for ordinary individuals to invest their savings.”).

<sup>141</sup> *Cargill, Inc. v. Hardin*, 452 F.2d 1154, 1163 (8th Cir. 1971) (“The methods and techniques of manipulation are limited only by the ingenuity of man.”).

<sup>142</sup> See, e.g., Tălis J. Putniņš, *Market Manipulation: A Survey*, 26 J. ECON. SURVS. 952, 955–62 (2012) (surveying studies and theories on market manipulation).

<sup>143</sup> See James Wm. Moore and Frank M. Wiseman, *Market Manipulation and the Exchange Act*, 2 U. CHI. L. REV. 46, 50 (1934) (“The term ‘manipulation’ may, in short, be applied to any practice which has as its purpose the deliberate raising, lowering or pegging of security prices. . . . Manipulation leads to an artificial and controlled price.” (footnote omitted)); Chester Spatt, *Security Market Manipulation*, 6 ANN. REV. FIN. ECON. 405, 407 (2014) (“The investor in a classical manipulation is attempting to influence artificially the price as a way to gain potential advantage.”).

<sup>144</sup> See, e.g., MARKHAM, *supra* note 137, at 17–25 (describing various historical manipulation episodes involving the use of cornering and squeezing); FED. TRADE COMM’N, REPORT ON THE GRAIN TRADE VOL. VII: EFFECTS OF FUTURE TRADING 244 (1926) (discussing cornering in the grain industry in the 1920s).

a financial instrument or commodity and then dictate the market prices of that instrument or commodity, thereby manipulating natural price discovery of the marketplace.<sup>145</sup> Squeezing operates in a similar manner. Squeezing generally occurs when one or more parties acquire a substantial supply of a financial instrument or commodity and then use their market power to manipulate market prices in their favor.<sup>146</sup> Both cornering and squeezing usually require large sums of capital to execute and sustain because they require the manipulative party to capture a dominant position in a particular market.<sup>147</sup>

Cornering and squeezing are less prevalent in the public capital markets today than in the past because of regulatory and market developments. In terms of regulatory developments, the initial passage and evolving enforcement of landmark legislation like the Sherman Antitrust Act, the Futures Trading Act, the Grains Future Act, the Securities Exchange Act, and the Commodity Exchange Act outlawed many forms of cornering and squeezing that were more prevalent during periods prior to the passage of these laws.<sup>148</sup> Beyond legal developments, the growth in financial markets has also made it more difficult for parties to acquire a complete or dominant position in a particular market to execute a cornering or squeezing scheme. As a rough macroeconomic barometer, the Dow Jones Industrial Average stood around 90 in January 1916 and over 16,000 in January 2016, exhibiting an exponential growth of over 17,000% in a century, not adjusting for inflation.<sup>149</sup> Markets for the financial instruments of significant publicly traded companies are also more difficult to corner or squeeze because of their large values. For instance, at one point in 2017, Apple had a market cap exceeding \$800 billion, and Facebook had a market cap exceeding \$400 billion.<sup>150</sup> Nevertheless, despite the decrease of cornering and squeezing schemes because of regulatory and market developments, these manipulative schemes still exist in discrete markets during

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<sup>145</sup> MARKHAM, *supra* note 137, at 3.

<sup>146</sup> *Id.*

<sup>147</sup> *Id.*

<sup>148</sup> *See id.* at 44, 50–51, 76–90 (discussing the passage and impact of various landmark legislation on market manipulation).

<sup>149</sup> *Dow Jones—100 Year Historical Chart*, MACROTRENDS, <http://www.macrotrends.net/1319/dow-jones-100-year-historical-chart> [<https://perma.cc/72NE-CTAR>] (last visited Mar. 31, 2017).

<sup>150</sup> *See* Anita Balakrishnan, *Apple Market Cap Tops \$800 Billion for the First Time*, CNBC.COM (May 8, 2017, 1:45 PM), <http://www.cnbc.com/2017/05/08/apple-market-capitalization-hits-800-billion.html> [<https://perma.cc/8N9Z-7VTR>]; Jonathan Taplin, *Is It Time to Break Up Google?*, N.Y. TIMES (Apr. 22, 2017), <https://www.nytimes.com/2017/04/22/opinion/sunday/is-it-time-to-break-up-google.html> (charting Facebook's market cap at \$414 billion as of April 20, 2017).

illiquid circumstances when one or more particular parties can acquire a dominant position.<sup>151</sup>

## 2. *Front Running*

Front running is a manipulative scheme where one party, frequently a broker, executes a trade, mindful that a market-moving trade is forthcoming in either the same or a related financial instrument. In such a scheme, the broker prioritizes his own trade ahead of the market-moving order to benefit himself in breach of a duty owed to clients.<sup>152</sup> Front running is generally considered illegal and a form of securities fraud.<sup>153</sup> Securities regulations explicitly prohibit front running large block trades of securities by broker-dealers.<sup>154</sup>

Front running distorts the fair execution of trades in the marketplace and allows parties with inside information about forthcoming trades to manipulate the marketplace for personal gain in violation of the law and in breach of their duties to their clients.<sup>155</sup> For instance, a broker can front run shares of Goldman Sachs if he executes a sell order for his own account after receiving—but before processing—a large sell order from Warren Buffett that is likely to move the price of Goldman shares downward. Similarly, a broker can facilitate front running by sharing his knowledge of a forthcoming order with a favored party, allowing that party to generate a quick gain with a timely trade.<sup>156</sup>

## 3. *Wash Trading*

Wash trading is a manipulation scheme whereby one or more parties execute sham orders with the goal of creating artificial movements in volume and price in the marketplace for their own benefit.<sup>157</sup> Wash trading can inflate prices of a

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<sup>151</sup> See JOHN L. TEALL, FINANCIAL TRADING AND INVESTING 336 (2013) (discussing select incidents of cornering and squeezing).

<sup>152</sup> See THOMAS LEE HAZEN, THE LAW OF SECURITIES REGULATION 574 (6th ed. 2009) (explaining variations of front running); Jerry W. Markham, “Front-Running”—*Insider Trading Under the Commodity Exchange Act*, 38 CATH. U. L. REV. 69, 70–71 (1988) (defining front running).

<sup>153</sup> See TEALL, *supra* note 151, at 330–31; Fox, Glosten & Rauterberg, *supra* note 7, at 227 n.87 (“Traditional front running is prohibited under the common law, federal law, and industry self-regulatory standards.”).

<sup>154</sup> See FINRA RULE 5270 (FINRA 2013); Exchange Act Release No. 34-14156, 1977 WL 190058, at \*1 (Nov. 9, 1977).

<sup>155</sup> See HAZEN, *supra* note 152, at 574.

<sup>156</sup> See HOWARD M. FRIEDMAN, SECURITIES REGULATION IN CYBERSPACE § 16–79 (3d ed. 2001 & Supp. 2008).

<sup>157</sup> TEALL, *supra* note 151, at 337.

financial instrument as the manipulating parties execute trade after trade at increasing prices, thereby causing unwitting, innocent parties to buy those instruments at artificially inflated prices.<sup>158</sup> Conversely, wash trading can also be a scheme to drive prices downward. The manipulating party or parties, in either scenario, are exposed to no real financial risk and stand only to gain from their deceitful methods that create illusory movements in prices and volume.<sup>159</sup> While wash trading schemes are frequently initiated to manipulate prices, they can also be initiated to generate rebates and kickbacks from vendors like exchanges and brokers.<sup>160</sup> Congress and the courts have long frowned upon wash trading as an illegal threat to the proper and fair functions of financial markets.<sup>161</sup>

#### 4. *Pumping-and-Dumping*

The pump-and-dump scheme generally operates by a manipulating party acquiring a position in a financial instrument, like a stock, then artificially inflating the stock through fraudulent promotion before selling its position to unsuspecting parties at the inflated price, which often crashes after the sale.<sup>162</sup> Cheaply-priced securities, so-called “penny stocks,” that are traded in less regulated, illiquid, over-the-counter markets are particularly vulnerable to these schemes because of their low values and the lack of information about them.<sup>163</sup> The pump-and-dump scheme has existed for centuries in financial markets,

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<sup>158</sup> See Charles R.P. Pouncy, *The Scierter Requirement and Wash Trading in Commodity Futures: The Knowledge Lost in Knowing*, 16 CARDOZO L. REV. 1625, 1637 (1995) (“Wash trading . . . is the archetypical form of fictitious trading.”).

<sup>159</sup> See MARKHAM, *supra* note 137, at 7–8.

<sup>160</sup> See, e.g., *Amanat v. SEC*, 269 F. App’x 217, 220 (3d Cir. 2008) (affirming on the illegality of wash trades designed to generate vendor rebates).

<sup>161</sup> See, e.g., *Wilson v. CFTC*, 322 F.3d 555, 559 (8th Cir. 2003) (opining that wash sales are “harmful because they create illusory price movements in the market”); *Graham v. SEC*, 222 F.3d 994, 996, 1003 (D.C. Cir. 2000) (characterizing wash sales as illegal stock market manipulation); *SEC v. U.S. Envtl. Inc.*, 155 F.3d 107, 112 (2d Cir. 1998) (finding wash sales as violations of federal securities antifraud law); *Rosenberg v. Hano*, 121 F.2d 818, 820 (3d Cir. 1941) (“[A]n honest security market depended on more than the exclusion of the cruder form of lying, such as wash sales, matched orders, and the like. . . . Such appraisal to be trustworthy . . . must reflect the honest judgment of those whose reason for buying is independent of and uninfluenced by its own probable effect.”); *Scopino*, *supra* note 84, at 266 (“Congress made wash sales illegal in 1936 with the passage of the CEA [Commodities Exchange Act] . . .”).

<sup>162</sup> See Spatt, *supra* note 143, at 408 (“[A] pump and dump involves a trader ‘pumping’ up the price of a company by spreading false information to many unsophisticated (often retail) investors to push up the share prices and then ‘dumping’ the trader’s shares.”); “*Pump-and-Dumps*” and *Market Manipulations*, U.S. SEC. & EXCH. COMM’N.: FAST ANSWERS, <http://www.sec.gov/answers/pumpdump.htm> (last modified June 25, 2013) (“Once these fraudsters ‘dump’ their shares and stop hyping the stock, the price typically falls, and investors lose their money.”).

<sup>163</sup> MARKHAM, *supra* note 137, at 257.

particularly those involving securities.<sup>164</sup> It has been traced back as far as the “South Sea Bubble” during the 1700s.<sup>165</sup>

More modern variations of pump-and-dump schemes involve the use of boiler rooms, Internet chat rooms, fraudulent websites, social media, and spam e-mails to artificially inflate securities as part of the manipulative scheme. First, boiler rooms refer to operations that promote securities via aggressive tactics to perpetuate securities fraud.<sup>166</sup> These aggressive tactics include high pressure cold calling, assuring high returns, and outright lying about the promoted securities.<sup>167</sup> These tactics are well depicted in popular culture through movies like *Boiler Room* and *The Wolf of Wall Street*.<sup>168</sup>

Second, the advent of the Internet created new ways to execute pump-and-dump schemes. Fraudsters promoted securities via chat rooms, websites, social media, and e-mails with the intent of hyping and selling nearly worthless securities to unsuspecting parties at artificially inflated prices.<sup>169</sup> Furthermore, new information technology substantially lowered the cost of fraudulently promoting a company, allowing sophisticated con artists as well as amateurs like high school students to manipulate markets with pump-and-dump schemes.<sup>170</sup>

Over the years, policymakers and regulators have tried vigilantly to combat pump-and-dump schemes through enforcement actions, new regulation, and new legislation. The SEC, for instance, has taken a number of pump-and-dump cases to trial.<sup>171</sup> The SEC also created the Office of Internet Enforcement to

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<sup>164</sup> *Id.*

<sup>165</sup> 1 JERRY W. MARKHAM, A FINANCIAL HISTORY OF THE UNITED STATES: FROM CHRISTOPHER COLUMBUS TO THE ROBBER BARONS (1492–1900), at 97–99 (2002).

<sup>166</sup> HAZEN, *supra* note 152, at 618–19.

<sup>167</sup> *Id.*; 3 JERRY W. MARKHAM, A FINANCIAL HISTORY OF THE UNITED STATES: FROM THE AGE OF DERIVATIVES INTO THE NEW MILLENNIUM (1970–2001), at 53–54 (2002); JOEL SELIGMAN, THE TRANSFORMATION OF WALL STREET: A HISTORY OF THE SECURITIES AND EXCHANGE COMMISSION AND MODERN CORPORATE FINANCE 24 (1982).

<sup>168</sup> *BOILER ROOM* (New Line Cinema 2000); *THE WOLF OF WALL STREET* (Paramount Pictures 2013).

<sup>169</sup> Nancy Toross, Comment, *Double-Click on This: Keeping Pace with On-Line Market Manipulation*, 32 LOY. L.A. L. REV. 1399, 1418–21 (1999); OFFICE OF INV’R EDUC. & ADVOCACY, U.S. SEC. & EXCH. COMM’N, INVESTOR ALERT: SOCIAL MEDIA AND INVESTING—AVOIDING FRAUD 1 (2012), <http://www.sec.gov/investor/alerts/socialmediaandfraud.pdf>.

<sup>170</sup> See MICHAEL LEWIS, *NEXT: THE FUTURE JUST HAPPENED* 27–28 (2002) (chronicling a lucrative market manipulation scheme initiated by a high school student); JERRY W. MARKHAM, A FINANCIAL HISTORY OF MODERN U.S. CORPORATE SCANDALS: FROM ENRON TO REFORM 27–29 (2006) (discussing pump-and-dump schemes involving characters of varying sophistication).

<sup>171</sup> *E.g.*, SEC v. Whittemore, 659 F.3d 1, 4 (D.C. Cir. 2011); United States v. Blinder, 10 F.3d 1468, 1471 (9th Cir. 1993); SEC v. Park, 99 F. Supp. 2d 889, 892 (N.D. Ill. 2000); SEC v. Berliner, Litigation Release No.

battle these attempts at market manipulation.<sup>172</sup> Furthermore, mindful that many of the schemes involve penny stocks, Congress passed the Securities Enforcement Remedies and Penny Stock Reform Act of 1990 to better protect investors and the marketplace from pump-and-dump schemes.<sup>173</sup>

### 5. *Benchmark Distortion*

Benchmark distortion generally operates by manipulating an influential standard or metric that is affiliated with various financial instruments and products in the marketplace.<sup>174</sup> By distorting the accuracy of benchmarks, manipulating parties can distort affiliated financial instruments and products in their favor to the detriment of honest participants in the marketplace.<sup>175</sup>

Financial markets are highly reliant on benchmarks as informational gauges of performance and value.<sup>176</sup> The Dow and the S&P 500 represent the value and performance of the U.S. stock market.<sup>177</sup> The gross domestic product (GDP) summarizes the economic performance of a country.<sup>178</sup> The consumer price index (CPI) indicates the cost of living by estimating the changes in prices of a basket of common goods and services.<sup>179</sup> The London InterBank Offered Rate (LIBOR) measures the interest rates between banks.<sup>180</sup> These and other financial benchmarks are frequently tied to numerous financial instruments that are traded in the marketplace. For instance, numerous widely held mutual funds, index funds, and exchange-traded funds are tied directly to the Dow and the S&P 500.<sup>181</sup> Similarly, the prices of bonds are influenced directly by LIBOR as it sets the baseline for pricing many bonds.<sup>182</sup>

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20537, 93 SEC Docket 214 (Apr. 24, 2008); SEC v. Ampudia, Litigation Release No. 20071, 90 SEC Docket 1178 (Apr. 6, 2007).

<sup>172</sup> U.S. SEC. & EXCH. COMM'N, ENFORCEMENT INTERNET PROGRAM: AUDIT No. 352 (2003), <http://www.sec.gov/about/oig/audit/352fin.htm>.

<sup>173</sup> Pub. L. No. 101-429, 104 Stat. 931 (1990).

<sup>174</sup> Andrew Verstein, *Benchmark Manipulation*, 56 B.C. L. REV. 215, 217–18 (2015).

<sup>175</sup> *Id.* at 218.

<sup>176</sup> Gabriel Rauterberg & Andrew Verstein, *Index Theory: The Law, Promise and Failure of Financial Indices*, 30 YALE J. ON REG. 1, 5–6 (2013).

<sup>177</sup> See HERBERT B. MAYO, INVESTMENTS: AN INTRODUCTION 345, 349–50 (10th ed. 2011) (explaining the Dow Jones Industrial Average and the S&P 500 Index).

<sup>178</sup> See *id.* at 376 (defining the gross domestic product).

<sup>179</sup> See *id.* at 380–81 (explaining the consumer price index).

<sup>180</sup> STEPHEN BLYTH, AN INTRODUCTION TO QUANTITATIVE FINANCE 27 (2014).

<sup>181</sup> See GARY L. GASTINEAU, THE EXCHANGE-TRADED FUNDS MANUAL 108–10 (2d ed. 2010) (discussing widely held exchange traded funds tied to the Dow Jones Industrial Average and the S&P 500 Index).

<sup>182</sup> See BLYTH, *supra* note 180, at 128–29.

Given the importance of benchmarks to financial markets, parties that attempt to manipulate the markets find benchmarks to be attractive targets. Distorting benchmarks requires less capital and can have greater impact than attempting to directly disrupt particular markets.<sup>183</sup> For instance, it would be incredibly expensive and cumbersome for one party to manipulate the multi-trillion dollar corporate bond or foreign exchange markets by directly trading bonds and currencies in its favor since doing so would require a large sum of capital and significant effort. However, a few significant parties can collude to distort key interest rates and foreign exchange benchmarks. As such, if colluding parties are able to manipulate key benchmarks, they then can indirectly manipulate all of the corporate bond, foreign exchange contracts, swaps, and derivatives tied to those key benchmarks.<sup>184</sup> In fact, between 2012 and 2015, numerous large financial institutions like Barclays, Citigroup, Deutsche Bank, JPMorgan Chase, Royal Bank of Scotland, and UBS paid billions of dollars in fines for their involvement in manipulating interest rates via LIBOR and foreign exchange rates over the course of many years.<sup>185</sup>

### B. *New Market Manipulation*

In contrast to the analog, human protagonists of traditional market manipulation, new market manipulation generally uses the electronic communications, information systems, and algorithmic platforms of the new, high-tech financial marketplace to unfairly distort information and prices relating to financial instruments or transactions. At its core, these distortive actions and effects tamper with the humans and computerized information and communications systems of the marketplace. They corrupt how humans and machines communicate between and amongst each other in the financial markets. As such, this Article has termed this new approach to market

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<sup>183</sup> Verstein, *supra* note 174, at 224–25.

<sup>184</sup> See, e.g., Kristin N. Johnson, *Governing Financial Markets: Regulating Conflicts*, 88 WASH. L. REV. 185, 188–89 (2013) (discussing the effects of LIBOR manipulation on the markets of various financial instruments).

<sup>185</sup> See DAVID ENRICH, *THE SPIDER NETWORK: THE WILD STORY OF A MATH GENIUS, A GANG OF BACKSTABBING BANKERS, AND ONE OF THE GREATEST SCAMS IN FINANCIAL HISTORY* 4–6 (2017); *In re LIBOR-Based Fin. Instruments Antitrust Litig.*, 962 F. Supp. 2d 606 (S.D.N.Y. 2013); Michael Corkery & Ben Protess, *Rigging of Foreign Exchange Market Makes Felons of Top Banks*, N.Y. TIMES (May 20, 2015), [https://www.nytimes.com/2015/05/21/business/dealbook/5-big-banks-to-pay-billions-and-plead-guilty-in-currency-and-interest-rate-cases.html?\\_r=0](https://www.nytimes.com/2015/05/21/business/dealbook/5-big-banks-to-pay-billions-and-plead-guilty-in-currency-and-interest-rate-cases.html?_r=0) [<https://perma.cc/R5VA-PGKS>]; Ben Protess & Jack Ewing, *Deutsche Bank to Pay \$2.5 Billion Fine to Settle Rate-Rigging Case*, N.Y. TIMES (Apr. 23, 2015), [https://www.nytimes.com/2015/04/24/business/dealbook/deutsche-bank-settlement-rates.html?\\_r=0](https://www.nytimes.com/2015/04/24/business/dealbook/deutsche-bank-settlement-rates.html?_r=0) [<https://perma.cc/HF9F-2TLU>].

manipulation, cybernetic market manipulation.<sup>186</sup> While cybernetic market manipulation generally shares the same goal as its traditional counterpart, it can be much more impactful because of the unparalleled interconnectedness and unprecedented value of modern financial markets. In some instances, cybernetic market manipulation represents the use of new financial technology to carry out old illicit schemes. In other instances, it represents the use of new financial technology to carry out new illicit schemes. A few of the more common and prominent methods of cybernetic market manipulation are pinging, spoofing, electronic front running, and mass misinformation.

### *1. Pinging and Spoofing*

Pinging and spoofing are two new methods of market manipulation that leverage the new financial technologies of the marketplace to distort the ordinary price discovery process in financial markets.

With pinging, a larger number of small orders for a particular financial instrument are submitted and cancelled in fractions of a second by computerized platforms to induce others in the marketplace to react to their “pings” and disclose their trading intentions to the pinging party.<sup>187</sup> Pinging allows the initiating party to discern valuable information at little to no risk since most of the pinging orders are cancelled prior to execution.<sup>188</sup> For instance, Honest Abbie wants to buy 100,000 shares of Acme at any price up to \$50 per share. Dishonest John, using the pinging strategy, sends out numerous small orders to sell Acme shares at various prices with no intention of honoring them. Honest Abbie reacts to Dishonest John’s orders and reveals her preferred volume and price points. Rather than being able to fulfill her large order at various price points, Honest Abbie will likely end up paying \$50 or more per share for her entire order since she has unwittingly revealed her preferences to her devious pinging counterparty. When pinging is done on a large scale, over a sustained period, it can cost investors and the marketplace significant sums of capital.<sup>189</sup>

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<sup>186</sup> See *Cybernetics*, OXFORD DICTIONARY, <https://en.oxforddictionaries.com/definition/cybernetics> (defining cybernetics as “the science of communications and automatic control systems in both machines and living things”); NORBERT WIENER, *CYBERNETICS OR CONTROL AND COMMUNICATION IN THE ANIMAL AND THE MACHINE* 12–16 (2d ed. 2013) (introducing and explaining the theory of cybernetics).

<sup>187</sup> See IRENE ALDRIDGE, *HIGH-FREQUENCY TRADING: A PRACTICAL GUIDE TO ALGORITHMIC STRATEGIES AND TRADING SYSTEMS* 201 (2d ed. 2013) (highlighting pinging and similar strategies); see also BROWN, *supra* note 57, at 113 (defining and discussing the process of pinging).

<sup>188</sup> BROWN, *supra* note 57, at 113.

<sup>189</sup> See, e.g., Gregory Scopino, *The (Questionable) Legality of High-Speed “Pinging” and “Front Running” in the Futures Market*, 47 CONN. L. REV. 607, 622–28 (2015).

With spoofing, orders are placed by computerized platforms for a financial instrument at prices outside the current bona fide limits to spook other market participants to react in a manner favorable to the spoofing party.<sup>190</sup> Spoofing allows the initiating party to distort the ordinary price discovery in the marketplace by placing orders with no intention of ever executing them and merely for the purpose of manipulating honest participants in the marketplace.<sup>191</sup> For instance, if shares of Citigroup are trading between \$59.98 and \$60.05 per share, a spoofing party will submit and cancel multiple limit orders to sell 100,000 shares at \$59.90 to trick others in the market into off-loading their positions before the stock drops. In 2010, FINRA sanctioned Trillium Brokerage Services with \$1 million in fines for engaging in illicit spoofing via their high frequency trading programs.<sup>192</sup> As noted earlier, part of the charges against Navinder Sarao alleged that he used spoofing to manipulate the market tied to S&P 500 futures and contributed to the Flash Crash.<sup>193</sup>

Both ping and spoofing are made possible by the evolution of market operations from a manual enterprise to a computerized enterprise.<sup>194</sup> The rise of autonomous, high-speed supercomputers running on smart algorithms made both methods of market manipulation possible and profitable since both ping and spoofing require the rapid submission and cancellation of voluminous orders measured in seconds.<sup>195</sup> Human traders and brokers who gather and execute trades in time increments measured in minutes and hours are simply too slow to execute these schemes in a profitable manner, given the voluminous order

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<sup>190</sup> See Commodity Exchange Act, 7 U.S.C. § 6c(a)(5)(C) (2012) (defining spoofing); François-Serge Lhabitant & Greg N. Gregoriou, *High Frequency Trading: Past, Present, and Future*, in THE HANDBOOK OF HIGH FREQUENCY TRADING 155, 161 (Greg N. Gregoriou ed., 2015) (explaining the mechanics of spoofing); Dina El Boghdady, *Is High-Frequency Trading a Threat to Stock Trading, or a Boon?*, WASH. POST (Oct. 25, 2012), [https://www.washingtonpost.com/business/economy/is-high-frequency-trading-a-threat-to-stock-trading-or-a-boon/2012/10/25/9c39ff96-1865-11e2-a55c-39408fb6a4b\\_story.html?tid=wp\\_ipad&utm\\_term=.e5d92d4bf62f](https://www.washingtonpost.com/business/economy/is-high-frequency-trading-a-threat-to-stock-trading-or-a-boon/2012/10/25/9c39ff96-1865-11e2-a55c-39408fb6a4b_story.html?tid=wp_ipad&utm_term=.e5d92d4bf62f) [<https://perma.cc/Q4BX-GM9D>] (“Computer programs try to bait institutional investors by simultaneously placing millions of offers to see where they get a bite, then quickly canceling them . . .”).

<sup>191</sup> Massimiliano Marzo, *Designing a Trading Market*, in MARKET MICROSTRUCTURE IN EMERGING AND DEVELOPED MARKETS 159, 171 (H. Kent Baker & Halil Kiyamaz eds., 2013).

<sup>192</sup> Press Release, Fin. Indus. Regulatory Auth., FINRA Sanctions Trillium Brokerage Services, LLC, Director of Trading, Chief Compliance Officer, and Nine Traders \$2.26 Million for Illicit Equities Trading Strategy (Sept. 13, 2010), <http://www.finra.org/newsroom/2010/finra-sanctions-trillium-brokerage-services-llc-director-trading-chief-compliance>.

<sup>193</sup> See *supra* Part I.A.2.

<sup>194</sup> Carol Clark & Rajeev Ranjan, *How Do Broker-Dealers/Futures Commission Merchants Control the Risks of High Speed Trading?* 3 (Fed. Reserve Bank Chi., Policy Discussion Paper No. 2012-3, 2012).

<sup>195</sup> *Id.*; PATTERSON, *supra* note 2, at 62–63, 208–09.

books.<sup>196</sup> High-frequency and algorithmic trading platforms can execute these schemes to gain fractions of a penny per trade to the tune of billions of dollars in profits by taking advantage of unsuspecting investors with slower execution speeds and other computerized traders with unsuspecting execution codes.<sup>197</sup>

There has been much recent debate and discussion among scholars and regulators about tactics like ping-pong and spoofing in connection with the rise of high-frequency trading and algorithmic systems in financial markets.<sup>198</sup> Policymakers and regulators have taken many important early steps to better understand and govern new manipulative tactics like ping-pong and spoofing.<sup>199</sup> In fact, the passage of the landmark Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank) expressly prohibited various disruptive and manipulative practices like spoofing in financial markets.<sup>200</sup> The efficacy of these preliminary actions on ping-pong and spoofing remains to be seen as unscrupulous market players continue to find new ways to manipulate the marketplace.

## 2. *Electronic Front Running*

Electronic front running is both similar and dissimilar from its traditional counterpart. Like its traditional counterpart, electronic front running seeks to manipulate the marketplace by executing trades ahead of a known future price change, thereby profiting once the price moving order is executed.<sup>201</sup> Unlike its traditional counterpart that front ran traders via human brokers in small batches, electronic front running frequently leverages new, high-tech mechanisms that allow brokers to gain an unfair glimpse into order flows at one trading venue and to jump ahead of those flows to their advantage at another trading venue.<sup>202</sup>

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<sup>196</sup> See Surowiecki, *supra* note 46 (“A human trader would never be able to quickly synthesize all the information in the order book, but a bot can.”).

<sup>197</sup> LEWIS, *supra* note 8, at 45–46.

<sup>198</sup> *E.g.*, Concept Release on Equity Market Structure, Exchange Act Release No. 34-61358, 75 Fed. Reg. 3594, 3609 (Jan. 21, 2010) (codified at 17 C.F.R. pt. 242); *Computerized Trading: What Should the Rules of the Road Be?: Hearing Before the Subcomm. on Sec., Ins., & Inv. of the S. Comm. on Banking, Housing, & Urban Affairs*, 112th Cong. 41–45 (2012) (statement of Andrew M. Brooks, Head of U.S. Equity Trading, T. Rowe Price); Clark & Ranjan, *supra* note 194, at 3; Scopino, *supra* note 189, at 610–14.

<sup>199</sup> See, *e.g.*, *supra* Part II.B (surveying the early regulatory response).

<sup>200</sup> See Commodity Futures Trading Commission, Antidisruptive Practices Authority, 76 Fed. Reg. 14,943, 14,944 (Mar. 18, 2011) (describing the disruptive practices prohibited by the Dodd-Frank Act).

<sup>201</sup> See Fox, Glosten & Rauterberg, *supra* note 7, at 226–33 (discussing the mechanics and implications of electronic front running).

<sup>202</sup> LEWIS, *supra* note 8, at 45.

New financial technology makes electronic front running possible. With new financial technology, a party can view a price change or transaction in one venue and race to execute an advantageous trade in another venue before the new price is reflected in the second venue. New financial technology has also made it possible for certain privileged parties to see order flows of other parties prior to their execution via special feeds or through a process called flash orders.<sup>203</sup> With a flash order, an exchange or electronic trading platform will “flash” order information to certain parties (usually those who pay a fee) prior to the information being made widely available in the marketplace.<sup>204</sup> The “flash” of an order normally exists for fractions of a second prior to publication, but because new financial technology can work in milliseconds, those given a quick peek can make an even quicker profit.<sup>205</sup> When the SEC permitted the practice of “flashing” by an order in 1978, they did so during an era of human traders on exchange floors and did not anticipate in the current era of autonomous, high-speed algorithmic programs trading in dark pools and electronic exchanges.<sup>206</sup>

In recent years, regulators and policymakers have examined flash orders and electronic front running but have not banned the practice.<sup>207</sup> The SEC proposed a rule in 2009 to eliminate the practice of flash orders, but the rule was never adopted.<sup>208</sup> It has been contended that while flash orders present the risk of front running and manipulation, they can also help enhance liquidity and reduce transaction costs in the marketplace.<sup>209</sup> While a general regulatory prohibition has not been issued, a number of private exchanges like IEX have banned the practice, while other exchanges continue to allow the practice.<sup>210</sup>

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<sup>203</sup> See TEALL, *supra* note 151, at 87; Yesha Yadav, *Insider Trading and Market Structure*, 63 UCLA L. REV. 968, 998–99 (2016) (discussing the special data access and exploitation of certain high frequency traders in the marketplace).

<sup>204</sup> LEWIS, *supra* note 8, at 45.

<sup>205</sup> THIERRY FOUCAULT, MARCO PAGANO & AILSA RÖELL, MARKET LIQUIDITY: THEORY, EVIDENCE, AND POLICY 212 (2013).

<sup>206</sup> *Fact Sheet: Banning Marketable Flash Orders*, U.S. SEC. & EXCHANGE COMMISSION (Sept. 7, 2009), <https://www.sec.gov/news/press/2009/2009-201-factsheet.htm>.

<sup>207</sup> See, e.g., *Dark Pools, Flash Orders, High-Frequency Trading, and Other Market Structure Issues: Hearing Before the Subcomm. on Sec., Ins., and Inv. of the S. Comm. on Banking, Hous., & Urban Affairs*, 111th Cong. 1 (2009) (opening statement of Jack Reed, Chairman).

<sup>208</sup> Elimination of Flash Order Exception from Rule 602 of Regulation NMS, Exchange Act Release No. 34-60684, 74 Fed. Reg. 48,632, 48,632 (Sept. 23, 2009).

<sup>209</sup> See MARKHAM, *supra* note 137, at 323; TEALL, *supra* note 151, at 88.

<sup>210</sup> See ALDRIDGE, *supra* note 187, at 211 (“At present, most exchanges have voluntarily banned flash orders, yet some exchanges, such as DirectEdge, persist in flash order executions.”).

### 3. *Mass Misinformation*

Unscrupulous parties can now leverage the mechanisms of new media technology and new financial technology to disrupt and distort financial markets on an unprecedented scale by disseminating bad data, fake news, and faulty information into a marketplace that thrives on accurate information.<sup>211</sup> This Article terms this new method of cybernetic market manipulation, *mass misinformation*. With mass misinformation schemes, parties can manipulate the marketplace through fake regulatory filings, fictitious news reports, erroneous data, and hacking.<sup>212</sup> Because the new financial marketplace is so reliant on interconnected information and communications systems, a distortion to one source of information can have a large, volatile cascading effect on the greater marketplace in the short run, and a confidence-jarring effect on the greater marketplace in the long run.<sup>213</sup> In fact, in 2016, the U.S. intelligence community ranked cyber and technological attacks, including the use of false data to manipulate artificial intelligence systems trading financial instruments, a leading global threat.<sup>214</sup> Furthermore, whereas traditional pump-and-dump schemes are most effective with little known, illiquid securities, mass misinformation schemes are most effective on well known, widely held securities because the misinformation is relevant for so many parties.

A successful massive misinformation scheme for a widely held company like Apple, Facebook, or General Electric could have a monetary impact measured in the billions of dollars and affect a significant population of investors since those companies make up large positions in retirement accounts. Furthermore, unlike many other methods of market manipulation, mass misinformation can be motivated by goals of personal profit as well as goals of non-profit disruption.

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<sup>211</sup> See, e.g., Zohar Goshen & Gideon Parchomovsky, *The Essential Role of Securities Regulation*, 55 DUKE L.J. 711, 714 (2006) (discussing the importance of accurate information in securities market); Sabrina Tavernise, *As Fake News Spreads Lies, More Readers Shrug at the Truth*, N.Y. TIMES (Dec. 6, 2016), <https://www.nytimes.com/2016/12/06/us/fake-news-partisan-republican-democrat.html> [<https://perma.cc/HN24-ZKY4>].

<sup>212</sup> See, e.g., BARRY VENGERIK ET AL., FIREEYE, HACKING THE STREET? FIN4 LIKELY PLAYING THE MARKET 3 (2014), <https://www.fireeye.com/content/dam/fireeye-www/global/en/current-threats/pdfs/rpt-fin4.pdf>.

<sup>213</sup> See PATTERSON, *supra* note 2, at 9–10 (highlighting the risks of “a vicious self-reinforcing feedback loop” in the new high-speed, electronic financial marketplace); Hope, *supra* note 91; Story & Bowley, *supra* note 112 (“It is also possible that stocks simply move faster today because of the quicker pace of news and trading, and so drops and surges in prices that might have been spread over days in past times are now condensed within hours.”).

<sup>214</sup> James R. Clapper, Director of National Intelligence, Worldwide Threat Assessment of the U.S. Intelligence Community, February 9, 2016, [https://www.dni.gov/files/documents/SASC\\_Unclassified\\_2016\\_ATA\\_SFR\\_FINAL.pdf](https://www.dni.gov/files/documents/SASC_Unclassified_2016_ATA_SFR_FINAL.pdf) [<https://perma.cc/2YY5-4PTN>].

Because of its dual motivations and its wide impact, mass misinformation may emerge as the most damaging form of market manipulation in terms of market value and investor confidence.

Episodes from recent history have exhibited the variety of ways mass misinformation can manipulate the marketplace. In 2000, a tech-savvy college student created and disseminated a fake press release online about an SEC investigation into Emulex that resulted in the company's stock falling from \$104 to \$43 per share, a loss of \$2.2 billion in market value.<sup>215</sup> In 2013, hackers infiltrated the Associated Press's Twitter account to falsely broadcast an attack on the White House that temporarily erased \$136 billion in market value when automated programs traded on the bogus news.<sup>216</sup> In 2014, it was revealed that Russian hackers infiltrated the NASDAQ main computer system that manages its trading data and process.<sup>217</sup> That same year, a group of cyber criminals dubbed as FIN4 hacked into the computer systems of Wall Street firms and other American corporations with the goal of stealing market-moving information to manipulate the global financial markets.<sup>218</sup> In 2015, a man in Bulgaria submitted fake takeover bids for Avon and Rocky Mountain Chocolate via the SEC's EDGAR electronic filing system to manipulate the stock prices of those companies.<sup>219</sup> Avon shares rose over 20% because of the false filing and were temporarily halted from trading.<sup>220</sup> Later in 2015, fraudsters created a fake Bloomberg News website to tout a nonexistent takeover of Twitter.<sup>221</sup> The fake news report caused Twitter shares to increase by 7% before crashing after the hoax was exposed.<sup>222</sup> As noted earlier, in 2015, the DOJ also revealed charges against a global syndicate of cybercriminals that used hacking and the dissemination of false information to orchestrate massive pump-and-dump schemes.<sup>223</sup>

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<sup>215</sup> MARC GOODMAN, *FUTURE CRIMES* 140–41 (2015).

<sup>216</sup> Chozick & Perloth, *supra* note 48.

<sup>217</sup> See Michael Riley, *How Russian Hackers Stole the Nasdaq*, BLOOMBERG BUSINESSWEEK (July 21, 2014, 4:11 PM), <https://www.bloomberg.com/news/articles/2014-07-17/how-russian-hackers-stole-the-nasdaq> [<https://perma.cc/7ZUH-EBTW>]; see also FIRE EYE, *APT28: A WINDOW INTO RUSSIA'S CYBER ESPIONAGE OPERATIONS?* 3–6 (2014).

<sup>218</sup> See VENGERIK ET AL., *supra* note 212, at 3; Perloth, *supra* note 3.

<sup>219</sup> Goldstein, *supra* note 3.

<sup>220</sup> *Id.*

<sup>221</sup> Michael J. de la Merced & Matthew Goldstein, *Twitter Shares Jump After Faked Bloomberg Report*, N.Y. TIMES (July 14, 2015), <https://www.nytimes.com/2015/07/15/business/dealbook/twitter-shares-jump-after-fake-bloomberg-report.html> [<https://perma.cc/WJ99-G9AQ>].

<sup>222</sup> *Id.*

<sup>223</sup> Massive Network Intrusions Press Release, *supra* note 4; see also Indictment, United States v. Shalon, S1 15 Cr. 333 (S.D.N.Y. 2015), <http://www.justice.gov/usao-sdny/file/792506/download>; Indictment, United

As financial markets become more sensitive to the confluence of new media technology and new financial technology, mass misinformation schemes to manipulate the marketplace will certainly become more prevalent. Financial markets will likely witness more audacious and innovative schemes to disrupt and distort the marketplace with bad data and false information in the coming years.

#### IV. REGULATORY CHALLENGES

Technological change in financial markets frequently leads to regulatory challenges, as old rules and laws become dull in the face of sharp, new financial realities.<sup>224</sup> The emergence of cybernetic market manipulation presents policy and regulatory challenges related to resources, detection, and enforcement.<sup>225</sup>

##### A. *Of Resources*

One of the key regulatory challenges posed by cybernetic market manipulation is a matter of resources. In particular, regulators may lack sufficient resources to better combat the new high-tech schemes that distort the marketplace.<sup>226</sup> While private firms in pursuit of greater profits regularly invest in new technology and better expertise to thrive in the new marketplace, regulators lack similar funding impetus, and are frequently constrained by political considerations.<sup>227</sup> Furthermore, private firms also expend significant

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States v. Murgio, 15 Cr. 769 (S.D.N.Y. 2015), <http://www.justice.gov/usao-sdny/file/792511/download>; Goldstein & Stevenson, *supra* note 4.

<sup>224</sup> See, e.g., Tara Bhupathi, *Technology's Latest Market Manipulator? High Frequency Trading: The Strategies, Tools, Risks, and Responses*, 11 N.C. J.L. & TECH. 377, 377–78 (2010) (“Rapid technological advances have . . . caus[ed] the legal world to either choose to judicially adapt old laws and policies to the new digital situations or to legislatively create new doctrines to deal with unforeseen challenges.”).

<sup>225</sup> See, e.g., Yadav, *supra* note 203, at 1030 (“Viewed through the lens of market infrastructure, it becomes clear that conventional doctrine is poorly equipped to deal with the complexities of increasing innovation.”).

<sup>226</sup> Timothy Lavin, *Monsters in the Market*, THE ATLANTIC (July/August 2010), <https://www.theatlantic.com/magazine/archive/2010/07/monsters-in-the-market/308122/> [<https://perma.cc/874V-52QL>].

<sup>227</sup> See, e.g., *Testimony on Budget and Management of the U.S. Securities and Exchange Commission: Hearing Before the H. Comm. on Fin. Servs., & the Subcomm. on Capital Mkts., Ins., and Gov't-Sponsored Enters. of the H. Comm. on Fin. Servs.*, 112th Cong. (2011) (statement of Robert Khuzami et al., Dir.s., Sec. Exch. Comm'n), <http://www.sec.gov/news/testimony/2011/ts031011directors.htm> (“Over the past decade, the SEC has faced significant challenges in maintaining a staffing level and budget sufficient to carry out its core mission. The SEC experienced three years of frozen or reduced budgets . . . that forced a reduction of 10 percent of the agency’s staff. Similarly, the agency’s investments in new or enhanced IT systems declined about 50 percent . . .”); Arthur Levitt Jr., *Don't Gut the S.E.C.*, N.Y. TIMES (Aug. 7, 2011), <http://www.nytimes.com/2011/08/08/opinion/dont-gut-the-sec.html> [<https://perma.cc/J9TR-YE6B>] (opining on the funding and political constraints on the SEC); Mark Maremont & Deborah Solomon, *Behind SEC's Failings: Caution, Tight Budget, '90s Exuberance*, WALL ST. J. (Dec. 24, 2003, 12:01 AM), <https://www.wsj.com/articles/>

resources to lobby policymakers for rules that favor their practices, while regulators lack similar lobbying influence.<sup>228</sup>

The lack of sufficient resources can lead to a regulatory deficit in technology and expertise to combat the surplus of cybernetic market manipulation schemes in today's complex, technologically advanced marketplace.<sup>229</sup> In terms of technology, regulators simply lack adequate resources to keep pace with private actors in the new marketplace.<sup>230</sup> While regulators have made strides in recent years to upgrade their dated technological capabilities through initiatives like MIDAS and NEAT, they still continue to lag in comparison to the technological capabilities of private firms in the financial industry.<sup>231</sup> For instance, it was reported in 2017 that the CFTC lacked the resources to examine the daily trading data that they are receiving from the CME Group, one of the leading futures and commodities exchanges.<sup>232</sup> As a result of the technological disparity, regulators are frequently using twentieth-century tools to combat 21st-century misconduct in the marketplace.<sup>233</sup> In terms of expertise, due in part to the lack of resources, regulators often lose many of their experts to private industry. Private firms are willing and able to pay for expertise at annual rates measured in millions of

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SB107223513870781900 [<https://perma.cc/7SF8-ER98>]; James B. Stewart, *Common Sense: As a Watchdog Starves, Wall St. Is Tossed a Bone*, N.Y. TIMES (July 16, 2011), <http://www.nytimes.com/2011/07/16/business/budget-cuts-to-sec-reduce-its-effectiveness.html> [<https://perma.cc/WTY4-PCTU>] (discussing the small budgets of financial regulators like the SEC).

<sup>228</sup> See JEFF CONNAUGHTON, *THE PAYOFF: WHY WALL STREET ALWAYS WINS* 113 (2012); ROBERT G. KAISER, ACT OF CONGRESS: HOW AMERICA'S ESSENTIAL INSTITUTION WORKS, AND HOW IT DOESN'T 127–41 (2013); Roberta S. Karmel, *IOSCO's Response to the Financial Crisis*, 37 J. CORP. L. 849, 853 (2012) (“Where regulated industries have so much power and influence over lawmakers, there is a lack of political will to engage in vigorous regulation even when regulators perceive the dangers of insufficient market place standards.”); Rebecca M. Kysar, *The Sun Also Rises: The Political Economy of Sunset Provisions in the Tax Code*, 40 GA. L. REV. 335, 392 (2006) (“Through campaign contributions and lobbyists, these [interest] groups seek legislative votes favorable to their interests from politicians.”); Eric Lipton & Ben Protess, *Banks' Lobbyists Help in Drafting Financial Bills*, N.Y. TIMES (May 23, 2013, 9:44 PM), [https://dealbook.nytimes.com/2013/05/23/banks-lobbyists-help-in-drafting-financial-bills/?\\_r=0](https://dealbook.nytimes.com/2013/05/23/banks-lobbyists-help-in-drafting-financial-bills/?_r=0) [<https://perma.cc/Z7ET-Y3NH>].

<sup>229</sup> See PATTERSON, *supra* note 2, at 230 (“The new hierarchy would be all about who owned the most powerful computers, the fastest links between markets, the most sophisticated algorithms—and the inside knowledge of how the market's plumbing was put together.”).

<sup>230</sup> See MARKHAM, *supra* note 137, at 406–07; Nathaniel Popper & Ben Protess, *To Regulate Rapid Traders, S.E.C. Turns to One of Them*, N.Y. TIMES (Oct. 7, 2012), <http://www.nytimes.com/2012/10/08/business/sec-regulators-turn-to-high-speed-trading-firm.html> [<https://perma.cc/NS3C-YRPW>].

<sup>231</sup> See, e.g., *supra* Part II.B (discussing new technological advances at the SEC).

<sup>232</sup> Matthew Leising, *Hunting for Dirty Deeds in the \$34 Trillion U.S. Futures Market*, BLOOMBERG BUSINESSWEEK (Feb. 16, 2017, 2:11 PM), <https://www.bloomberg.com/news/articles/2017-02-16/hunting-for-dirty-deeds-in-the-34-trillion-u-s-futures-market> [<https://perma.cc/66RU-DHBV>].

<sup>233</sup> See Patterson, *supra* note 122.

dollars, while government regulators can only pay a fraction of that sum.<sup>234</sup> As a result of the expertise disparity, regulators may lack the latest knowledge to fully understand all the new ways the marketplace can be manipulated.<sup>235</sup>

In sum, resource asymmetries that affect regulatory technology and expertise present one of the critical challenges for regulators as they seek to combat the new schemes of manipulation emerging in the marketplace.

### *B. Of Detection*

The emerging modes of cybernetic market manipulation are particularly challenging for resource-constrained regulators because they are incredibly difficult to detect due to the accelerated speed, data deluge, and balkanization of the marketplace.<sup>236</sup>

First, the unprecedented speed of many of today's transactions and trades makes it especially tough for regulators to pinpoint ongoing market manipulation schemes. Powered by autonomous supercomputers linked to high-speed communication networks, trillions of dollars worth of trades and transactions occur at speeds measured in milliseconds.<sup>237</sup> As such, significant movements in market prices can last for merely milliseconds.<sup>238</sup> Today, high-frequency trading accounts—for trade volumes and dollar values—measure in the hundreds of billions daily.<sup>239</sup> In recent years, high-frequency trading has accounted for 30% of all foreign-exchange transactions, 35% to 40% of all

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<sup>234</sup> See, e.g., U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-11-654, SECURITIES AND EXCHANGE COMMISSION: EXISTING POST-EMPLOYMENT CONTROLS COULD BE FURTHER STRENGTHENED (2011), <http://www.gao.gov/new.items/d11654.pdf> (studying the revolving door between the SEC and the private sector); MICHAEL SMALLBERG, DANGEROUS LIAISONS: REVOLVING DOOR AT SEC CREATES RISK OF REGULATORY CAPTURE (2013), <http://pogoarchives.org/ebooks/20130211-dangerous-liaisons-sec-revolving-door.pdf>; JAMES Q. WILSON & JOHN J. DILULIO, JR., AMERICAN GOVERNMENT: INSTITUTIONS AND POLICIES 278 (11th ed. 2008) ("Every year, hundreds of people leave important jobs in the federal government to take more lucrative positions in private industry.").

<sup>235</sup> PATTERSON, *supra* note 2, at 230.

<sup>236</sup> For a general discussion of the historical development of the U.S. financial marketplace, see DeYoung, *supra* note 85, at 41; Mester, *supra* note 85, at 67–72; Scopino, *supra* note 84, at 223–25; Wilmarth, *supra* note 85.

<sup>237</sup> Fabozzi, Focardi & Jonas, *supra* note 104, at 8–10.

<sup>238</sup> NEIL JOHNSON ET AL., SCI. REPORTS 3: 2627 DOI: 10.1038/SREP02627, ABRUPT RISE OF NEW MACHINE ECOLOGY BEYOND HUMAN RESPONSE TIME (2013).

<sup>239</sup> See Korsmo, *supra* note 7, at 541–42; Eric Dash & Christine Hauser, *As Dizzying Week Ends on Wall St., Dangers Linger*, N.Y. TIMES (Aug. 11, 2011), <http://www.nytimes.com/2011/08/13/business/daily-stock-market-activity.html> [<https://perma.cc/M5AQ-SMU4>].

European equity trading, and 60% of all U.S. equity trading.<sup>240</sup> This emphasis on speed in the marketplace has conferred a competitive advantage to private firms with the resources to attain better technology and better real estate to reduce their latency periods and enhance their execution speeds.<sup>241</sup>

Despite recent moves to upgrade their technological capabilities, financial regulators still lack the wherewithal to keep up with private firms in a marketplace that is constantly moving larger and larger volumes faster and faster.<sup>242</sup> It has been estimated that the average investment period for equities in the United States alone has shortened dramatically from years to months to seconds in the last few decades.<sup>243</sup> Given the astonishing velocity and volume of the marketplace, regulators currently lack the ability to meaningfully monitor in real-time every trade and transaction to detect suspicious, manipulative activities. Rather than *ex ante* detection and prevention of cybernetic market manipulation schemes, regulators have focused on *ex post* investigations of voluminous trading data to discern market manipulation.<sup>244</sup> As financial technology continues to accelerate, detection of cybernetic market manipulation schemes will grow even more challenging for regulators.

Second, the increasing influence of digital data and information has made detecting the new methods of market manipulation much more challenging for regulators.<sup>245</sup> Today's financial marketplace is more data driven and more data sensitive than ever before. An ordinary trading day in the American capital markets can generate over a trillion bytes of data.<sup>246</sup> Algorithmic computer programs processing deluges of data are behind many financial transactions in

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<sup>240</sup> See, e.g., Bowley, *supra* note 55; Fabozzi, Focardi & Jonas, *supra* note 104, at 8; Neil Shah, *High-Speed Traders Dive into Forex Despite Doubts*, WALL ST. J. (Apr. 25, 2011, 11:59 AM), <http://online.wsj.com/article/SB10001424052748704677404576284921020282968.html> [<https://perma.cc/P3ZF-J4TA>].

<sup>241</sup> See Concept Release on Equity Market Structure, Exchange Act Release No. 34-61358, 75 Fed. Reg. 3594, 3610 (Jan. 21, 2010) (codified at 17 C.F.R. pt. 242) (discussing the importance of co-located real estate and financial technology in the marketplace); BROWN, *supra* note 57, at 63 (explaining how real estate and technology affect financial execution speed).

<sup>242</sup> See David Schneider, *Trading at the Speed of Light*, IEEE SPECTRUM, Oct. 2011, at 11, 11–12; Wissner-Gross & Freer, *supra* note 120 (studying arbitrage opportunities as trading nears the speed of light).

<sup>243</sup> PATTERSON, *supra* note 2, at 46 (“At the end of World War II, the average holding period for a stock was four years. By 2000, it was eight months. By 2008, it was two months. And by 2011 it was *twenty-two seconds* . . .”).

<sup>244</sup> Philips & Brush, *supra* note 134.

<sup>245</sup> See, e.g., Salil K. Mehra, *Antitrust and the Robo-Seller: Competition in the Time of Algorithms*, 100 MINN. L. REV. 1323, 1351 (2016) (discussing similar difficulties posed by algorithmic programs for antitrust law).

<sup>246</sup> *Enough Already!*, NANEX, <http://www.nanex.net/Research/Emini2/EMini2.html> (last updated Apr. 2, 2012).

today's marketplace.<sup>247</sup> These programs can be designed to analyze mountains of data, identify valuable opportunities, and invest accordingly without any human assistance.<sup>248</sup> Because the marketplace is becoming increasingly more sensitive to data, there arises greater opportunities for bad actors to manipulate the marketplace by distorting data or disseminating bad information through countless mediums.

Despite significant improvements in their information-technology capabilities, financial regulators remain lacking in their capabilities to better detect cybernetic market manipulation schemes in the face of the data revolution within the financial marketplace, and more broadly in the greater economy.<sup>249</sup> In 2013, it was reported that 90% of the world's data at that time was generated in the previous two years.<sup>250</sup> It has also been estimated that the overwhelming amount of the world's information is now stored digitally.<sup>251</sup> Furthermore, algorithmic programs are learning to process a wider variety and volume of data year after year. Market-moving data need not only mean financial information, but it can also mean social media data, mapping data, consumer data, and other types of information not traditionally considered relevant to finance.<sup>252</sup> As more and more digital data becomes available for algorithmic programs that serve as the engines of the marketplace, regulators lacking in adequate technology will be further challenged with attempts to manipulate financial markets via digital data distortions.

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<sup>247</sup> See, e.g., ROBERT A. G. MONKS & ALEXANDRA REED LAJOUX, CORPORATE VALUATION FOR PORTFOLIO INVESTMENT: ANALYZING ASSETS, EARNINGS, CASH FLOW, STOCK PRICE, GOVERNANCE, AND SPECIAL SITUATIONS 229 (2011); FINANCIAL CRISIS INQUIRY REPORT, *supra* note 88, at 44.

<sup>248</sup> See Concept Release on Risk Controls and System Safeguards for Automated Trading Environments, 78 Fed. Reg. 56,542, 56,573 app. 2 (Sept. 12, 2013) ("Automated trading systems, including high frequency traders, enter the market and execute trades in a matter of milliseconds without human involvement."); Charles Duhigg, *Stock Traders Find Speed Pays, in Milliseconds*, N.Y. TIMES (July 23, 2009), <http://www.nytimes.com/2009/07/24/business/24trading.html> [<https://perma.cc/J4A8-36QH>] ("[Algorithmic computer programs] can spot trends before other investors can blink, changing orders and strategies within milliseconds.").

<sup>249</sup> Cf. VIKTOR MAYER-SCHÖNBERGER & KENNETH CUKIER, BIG DATA: A REVOLUTION THAT WILL TRANSFORM HOW WE LIVE, WORK, AND THINK 6–10 (2013); NATE SILVER, THE SIGNAL AND THE NOISE: WHY SO MANY PREDICTIONS FAIL—BUT SOME DON'T 9–10 (2012); Andrew McAfee & Erik Brynjolfsson, *Big Data: The Management Revolution*, HARV. BUS. REV. 61, 62–68 (2012).

<sup>250</sup> Åse Dragland, *Big Data, For Better or Worse: 90% of World's Data Generated over Last Two Years*, SCIENCE DAILY (May 22, 2013), [www.sciencedaily.com/releases/2013/05/130522085217.htm](http://www.sciencedaily.com/releases/2013/05/130522085217.htm).

<sup>251</sup> See Don Peck, *They're Watching You at Work*, THE ATLANTIC (Dec. 2013), <https://www.theatlantic.com/magazine/archive/2013/12/theyre-watching-you-at-work/354681/> [<https://perma.cc/2P8W-TCNY>] ("[M]ore than 98 percent of the world's information is now stored digitally, and the volume of that data has quadrupled since 2007.").

<sup>252</sup> See ROBERT S. KRICHEFF, DATA ANALYTICS FOR CORPORATE DEBT MARKETS: USING DATA FOR INVESTING, TRADING, CAPITAL MARKETS, AND PORTFOLIO MANAGEMENT 55–60 (2014); FRANK OHLHORST, BIG DATA ANALYTICS: TURNING BIG DATA INTO BIG MONEY 37–46 (2013).

Third, in addition to the increases of market speed and market data, the increasing balkanization of the marketplace will make it more difficult for regulators to detect new modes of cybernetic market manipulation as there are more forums for market mischief. Traditional dominant financial forums such as public stock exchanges like the New York Stock Exchange and the NASDAQ are less relevant in today's fragmented financial marketplace.<sup>253</sup> When the New York Stock Exchange halted trading for several hours in July of 2015, the equity markets continued to function without any serious disruption since so much of the market activity already takes place in alternative trading venues.<sup>254</sup> In other eras, a failure of the New York Stock Exchange would have brought a majority of equity trading in the United States to a halt.<sup>255</sup> In today's fragmented marketplace, that is no longer the case. In 2016, there were over twenty registered national exchanges and around seventy total trading venues for securities and futures trading.<sup>256</sup> Additionally, more and more market activities are taking place in private electronic venues called "dark pools."<sup>257</sup> In fact, most equities in the United States, including those listed on the NASDAQ and the New York Stock Exchange are traded in dark pools instead of the public exchanges.<sup>258</sup> Dark pools are regulated differently than registered exchanges,

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<sup>253</sup> See Langevoort & Thompson, *supra* note 7, at 347 ("Today, liquidity is now much more possible outside of traditional exchanges. In the new millennium, cheap information and low communication costs have expanded markets . . ."); Michael J. de la Merced, *An Offline N.Y.S.E. Makes Barely a Ripple in a Day's Trading*, N.Y. TIMES (July 8, 2015), <https://www.nytimes.com/2015/07/09/business/dealbook/an-offline-nyse-makes-barely-a-ripple-in-a-days-trading.html> [<https://perma.cc/V6QA-PFYH>] ("Investors, however, need not rely on traditional exchanges to trade their shares at all. . . . Now, many Wall Street firms execute trades within their own systems.").

<sup>254</sup> de la Merced, *supra* note 253.

<sup>255</sup> *Id.*

<sup>256</sup> Michael MacKenzie, Kara Scannell & Nicole Bullock, *Share Trades: Murky Pools*, FIN. TIMES (June 27, 2014), <https://www.ft.com/content/a22603c4-fde1-11e3-acf8-00144feab7de> [<https://perma.cc/XAE3-BUVC>] (reporting that "there are 70 trading venues in the US, including 40 dark pools"); *Fast Answers*, U.S. SEC. & EXCHANGE COMMISSION, <http://www.sec.gov/divisions/marketreg/mrexchanges.shtml> (last modified Aug. 30, 2012).

<sup>257</sup> See Regulation of Non-Public Trading Interest, Exchange Act Release No. 34-60997, 97 SEC Docket 472, 473 (June 28, 2010) ("Such trading interest is considered non-public, or 'dark,' primarily because it is not included in the consolidated quotation data for NMS stocks that is widely disseminated to the public."); SAL ARNUK & JOSEPH SALUZZI, BROKEN MARKETS: HOW HIGH FREQUENCY TRADING AND PREDATORY PRACTICES ON WALL STREET ARE DESTROYING INVESTOR CONFIDENCE AND YOUR PORTFOLIO 62 (2012) ("The number of dark pools and ATSS has also skyrocketed over the past decade. Today, nearly one in every three shares trades off-exchange. There are currently approximately 40 such dark pools, where stocks trade without their orders displayed to the public."); Philips, *supra* note 56; Mary L. Schapiro, Chairman, U.S. Sec. & Exch. Comm'n, Statement on Dark Pool Regulation Before the Commission Open Meeting (Oct. 21, 2009) (transcript available at <http://www.sec.gov/news/speech/2009/spch102109mls.htm>).

<sup>258</sup> See Nathaniel Popper, *Public Exchanges Duel with Newcomers over Trade Transparency*, N.Y. TIMES (June 26, 2012), <http://www.nytimes.com/2012/06/27/business/stock-exchanges-duel-with-newcomers-over->

and can also facilitate complex financial arrangements in relatively less liquid instruments with relatively less regulation, compared to traditional trading forums.<sup>259</sup> As a result of these dynamics, dark pools can be ripe for manipulative and fraudulent behavior. In 2016, for instance, Barclays and Credit Suisse agreed to pay a combined \$154.3 million for wrongdoing in connection with their respective dark pools.<sup>260</sup>

Despite new powers since the last financial crisis, regulators still lack the resources and tools to timely detect market manipulation in this increasingly balkanized global marketplace.<sup>261</sup> As the marketplace grows more and more fragmented, regulators will be further challenged in their efforts to detect and deter the new methods of market manipulation.

In sum, it will be challenging for regulators to detect and deter the new forms of cybernetic market manipulation because they lack the resources and technology to smartly monitor a marketplace of increasingly accelerated speed, massive volumes of data, and balkanized intermediaries. Without the proper resources and tools, asking regulators to detect and prevent new schemes of market manipulation is akin to asking them to find particular grains of sand during a sandstorm in the desert while partially blindfolded.

### C. *Of Enforcement*

In addition to the regulatory challenges relating to resources and detection, the new modes of market manipulation also present enforcement challenges for regulators because longstanding laws against market manipulation are not well suited to address the new cybernetic methods of distorting and disrupting the marketplace.<sup>262</sup> In particular, laws have historically focused on schemes

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trade-transparency.html [https://perma.cc/CFE9-R2UA]; Nelson D. Schwartz & Louise Story, *Surge of Computer Selling After Apparent Glitch Sends Stocks Plunging*, N.Y. TIMES (May 6, 2010), <http://www.nytimes.com/2010/05/07/business/economy/07trade.html> [https://perma.cc/44EX-6VAY].

<sup>259</sup> See Steven L. Schwarcz, *Regulating Shadow Banking*, 31 REV. BANKING & FIN. L. 619, 627–28 (2012).

<sup>260</sup> Liz Moyer, *Barclays and Credit Suisse to Settle 'Dark Pool' Inquiries*, N.Y. TIMES (Jan. 31, 2016), <https://www.nytimes.com/2016/02/01/business/dealbook/barclays-and-credit-suisse-to-settle-dark-pool-inquiries.html> [https://perma.cc/7HAL-CTKF].

<sup>261</sup> For instance, pursuant to Dodd-Frank, regulators were granted powers to monitor disruptive practices in the marketplace, but the full practical implementation of those powers remain forthcoming. See Antidisruptive Practices Authority, 76 Fed. Reg. 14,943, 14,944 (Mar. 18, 2011).

<sup>262</sup> See MARKHAM, *supra* note 137, at 390–91; Scopino, *supra* note 84, at 222 (“Today, federal regulators are faced with a very different and yet in some ways similar task: monitoring the actions of artificially-intelligent algorithmic trading robots—frequently referred to as ‘algo bots’—in a continuous effort to combat price manipulation and disruptive trading practices in the markets . . . .”); Yesha Yadav, *The Failure of Liability in*

effectuated by human actors with the ill intent to manipulate the markets and not on schemes that largely utilize autonomous computerized systems.<sup>263</sup> While one could attempt to retrofit the traditional legal understandings to the new financial reality, it is difficult to claim that laws that focus on natural legal persons should naturally and seamlessly apply to autonomous, artificially intelligent systems.<sup>264</sup>

Like many forms of market misconduct, scienter, or intent, has long been a critical component of market manipulation violations pursuant to either the Commodities Exchange Act or the Securities Exchange Act.<sup>265</sup> In fact, a 1984 joint report by the CFTC, Federal Reserve, and SEC stated that the element of intent was essential to all market manipulation claims.<sup>266</sup> Whereas in eras past, regulators could establish the element of intent by the testimony of co-conspirators in a scheme, establishing intent becomes more difficult when the critical entity of an alleged scheme is an autonomous, algorithmic program that uses artificial intelligence with little to no human input after initial installation.<sup>267</sup>

Further complicating the enforcement issue for regulators is the fact that in the absence of the requisite ill intent to manipulate the marketplace, some of the cybernetic tactics are arguably legitimate trading and investment strategies that cannot be easily distinguished from the tactics of illegal market manipulators.<sup>268</sup>

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*Modern Markets*, 106 VA. L. REV. 1031, 1034–39 (2016) (discussing how traditional securities liability regimes are losing relevance in the modern marketplace).

<sup>263</sup> See, e.g., MARKHAM, *supra* note 137, at 400–06; Scopino, *supra* note 84, at 250 (“[S]cienter—or a culpable mental state—is a required element of the majority of civil claims involving manipulation, abusive market practices, or financial fraud. Only humans and business entities are considered ‘persons’ for purposes of the law. Noticeably, that leaves out computers and software programs . . . .” (footnotes omitted)).

<sup>264</sup> See, e.g., SAMIR CHOPRA & LAURENCE F. WHITE, A LEGAL THEORY FOR AUTONOMOUS ARTIFICIAL AGENTS 153–63 (2011); Lawrence B. Solum, *Legal Personhood for Artificial Intelligences*, 70 N.C. L. REV. 1231, 1231–33 (1992).

<sup>265</sup> See MARKHAM, *supra* note 137, at 375–76 (explaining the importance of scienter in market manipulation claims); Scopino, *supra* note 84, at 233 (“Many causes of action under the CEA require proof that a human involved with the improper activity acted with a culpable mental state.”); Yadav, *supra* note 262, at 1053 (“The hallmark of actions to pursue fraud and manipulation lies in the requirement to show that defendants intended to lie or to deliberately alter prices in securities markets.”).

<sup>266</sup> See Board of Gov. of Fed. Res., et al., Study of the Effects on the Economy of Trading in Futures and Options Pursuant to Section 23(a) of the Commodity Exchange Act as Amended VII–3 (Dec. 1984); MARKHAM, *supra* note 137, at 375 (highlighting the 1984 joint report’s acknowledgment of intent as a core market manipulation element),

<sup>267</sup> See Scopino, *supra* note 84, at 233 (“[C]auses of action [requiring scienter] would be ineffective in circumstances where computerized trading bots, without specific human direction, engaged in disruptive trading conduct while continuously modifying their own algorithms . . . .”).

<sup>268</sup> See Verstein, *supra* note 174, at 272 (“Defining ‘manipulation’ has proven a perennial difficulty among scholars of manipulation . . . .”); see also Ledgerwood & Carpenter, *supra* note 10, at 260 (discussing the

For instance, pinging and spoofing without the requisite intent to manipulate the market are considered by many to be legitimate strategies used by many traders and algorithmic trading programs to conceal their true motivations from the marketplace.<sup>269</sup> In fact, it has long been debated by scholars whether many forms of market manipulation should be regulated at all because they are difficult to identify and may be corrected by market forces in the absence of regulation.<sup>270</sup>

While regulators could attempt to directly enforce traditional laws against the new methods of manipulation or use new powers under Dodd-Frank and other new grants of authority, they will be lacking in meaningful precedent in the near term, particularly on the issue of scienter.<sup>271</sup> This does not mean to suggest that existing antifraud and anti-manipulation regulation and laws cannot be adapted to the new financial realities of the marketplace, just that they have not yet been so adopted. Powerful rules like the SEC's bedrock Rule 10b-5<sup>272</sup> and the CFTC's newer Rule 180.1<sup>273</sup> may ultimately catch up to new market realities.<sup>274</sup> In the meantime, regulators can use rules like the Market Access

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difficulties of enforcing anti-manipulation statutes); Tara E. Levens, Comment, *Too Fast, Too Frequent? High Frequency Trading and Security Class Actions*, 82 U. CHI. L. REV. 1511, 1515 (2015) (explaining how certain legitimate trading programs and patterns may appear similar to manipulative schemes).

<sup>269</sup> See, e.g., Frank H. Easterbrook, *Monopoly, Manipulation, and the Regulation of Futures Markets*, 59 J. BUS. S103, S118 (1986) (suggesting the concealing of one's true motivations in a trade does not necessarily amount to market manipulation); Jerry W. Markham, *Manipulation of Commodity Futures Prices—The Unprosecutable Crime*, 8 YALE J. ON REG. 281, 356–57 (1991) (opining on the heavy burden of proof to establish specific intent to manipulate market prices).

<sup>270</sup> See Franklin Allen & Douglas Gale, *Stock-Price Manipulation*, 5 REV. FIN. STUD. 503, 506 (1992) (opining that natural market forces of supply and demand make stock market manipulation self-defeating); Daniel R. Fischel & David J. Ross, *Should the Law Prohibit "Manipulation" in Financial Markets?*, 105 HARV. L. REV. 503, 544 (1991) (arguing that noncompetitive manipulative trades should not be prohibited as a matter of law); Merritt B. Fox, Lawrence R. Glosten & Paul C. Tetlock, *Short Selling and the News: A Preliminary Report on an Empirical Study*, 54 N.Y.L. SCH. L. REV. 645, 653 (2009–2010) ("[P]ure manipulations cannot be expected to yield much profit, if any, because the purchase orders needed to effect a cover will push prices up just as the sale orders prompted by the original short sale pushed them down."); Albert S. Kyle & S. Viswanathan, *How to Define Illegal Price Manipulation*, 98 AM. ECON. REV. 274, 274 (2008) (advocating for a narrower definition of illegal market manipulation); Steve Thel, *\$850,000 in Six Minutes—The Mechanics of Securities Manipulation*, 79 CORNELL L. REV. 219, 261 (1994) (suggesting that certain trade orient forms of manipulation are "self-detering").

<sup>271</sup> See Antidisruptive Practices Authority, 78 Fed. Reg. 31,890, 31,895 (May 28, 2013) (stating that the CFTC will use securities law precedents for certain market manipulation claims given the dearth of precedents relating to the commodities and futures markets); MARKHAM, *supra* note 137, at 397 (highlighting the difficulties in utilizing new grants of power under Dodd-Frank absent statutory clarity and meaningful precedents).

<sup>272</sup> 17 C.F.R. § 240.10b-5 (2017).

<sup>273</sup> 17 C.F.R. § 180.1 (2017).

<sup>274</sup> See, e.g., *Blue Chip Stamps v. Manor Drug Stores*, 421 U.S. 723, 737 (1975) (comparing Rule 10b-5 to "a judicial oak which has grown from little more than a legislative acorn"); John C. Coffee, Jr., *Introduction: Mapping the Future of Insider Trading Law: Of Boundaries, Gaps, and Strategies*, 2013 COLUM. BUS. L. REV. 281, 317 ("Rule 10b-5 was intended to evolve to keep pace with the ingenuity of fraudsters."); Scopino, *supra*

Rule that require proper supervision to indirectly combat the new schemes of market manipulation while sidestepping the thorny issue of scienter.<sup>275</sup> Nevertheless, until new precedents, principles, and rules are firmly established, there will be significant enforcement challenges for regulators as they combat the new methods of market manipulation.<sup>276</sup>

## V. IMPLICATIONS AND RECOMMENDATIONS

The emergence of cybernetic market manipulation in the new high-tech financial marketplace will have numerous implications for institutions, regulators, and investors. While a consensus in the debates concerning the larger regulatory questions about the new modes of market manipulation remains forthcoming, there are, nevertheless, preliminary steps that can be taken to address the looming implications confronting institutions, regulators, and investors. In particular, near term action can be taken to enhance the integrity of financial intermediaries, improve financial cybersecurity, and safeguard the investments of ordinary investors.

### A. *Intermediary Integrity*

One of the key implications from the emergence of cybernetic market manipulation methods will be greater effort from financial intermediaries to safeguard the sanctity of the marketplace from tampering and distortion since regulators face serious resource constraints.<sup>277</sup> As such, policymakers should embrace an organizing principle that this Article terms *intermediary integrity* to help guide intermediaries towards developing best practices to protect the marketplace from the threats of manipulation.

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note 189, at 686–90 (arguing for possible application of existing law against new forms of market manipulation like ping-pong and electronic front running).

<sup>275</sup> See, e.g., 15 U.S.C. § 78o(b)(4)(E) (2012) (mandating “reasonabl[e] supervis[ion]” of broker-dealers); *In re FXDirectDealer, LLC*, CFTC No. 13-34, 2013 WL 11069513, at \*1 (Sept. 18, 2013); *In re Forex Capital Mkts., LLC*, CFTC No. 12-01, 2011 WL 4689390, at \*1 (Oct. 3, 2011); 17 C.F.R. § 240.15c3–5 (2017); 17 C.F.R. § 166.3 (2017) (requiring diligent supervision in the commodities marketplace); Scopino, *supra* note 84, at 284 (“[T]he CFTC already has brought cases asserting Regulation 166.3 violations in which registrants’ employees failed to diligently supervise employees who were responsible for programming, overseeing, or controlling their electronic trading platforms.”).

<sup>276</sup> Jonathan Mayer, *Cybercrime Litigation*, 164 U. PA. L. REV. 1453, 1505–07 (2016).

<sup>277</sup> See Gregory Scopino, *Preparing Financial Regulation for the Second Machine Age: The Need for Oversight of Digital Intermediaries in the Futures Market*, 2015 COLUM. BUS. L. REV. 439, 518–19 (advocating for greater regulatory attention on emerging financial “digital intermediaries”); see also Jonathan Zittrain, *A History of Online Gatekeeping*, 19 HARV. J.L. & TECH. 253, 253–54 (2006) (making a similar argument in the context of online activities).

Financial intermediaries must serve as stronger sentinels against market manipulation because attempts at manipulation frequently happen at the intermediary level, and not at the market level.<sup>278</sup> The financial marketplace is truly a market of intermediaries of various types and sizes.<sup>279</sup> Intermediation is an existential fact of modern finance.<sup>280</sup> Investment banks, commercial banks, mutual funds, stock exchanges, clearinghouses, brokerages, and other intermediaries form the modern financial infrastructure.<sup>281</sup> Because financial intermediaries serve as the locus of market activity, they also serve as the locus of market manipulation. For instance, if one endeavored to manipulate the stock price of Alphabet, Google's parent company, one would likely attempt to manipulate the mechanisms of a stock exchange or trading platform that deals in the company's shares, not the entire market for Alphabet stock itself. Manipulating the entire market for Alphabet stock through direct, actual trading is extremely difficult because the market capitalization for Alphabet stock was valued at around \$550 billion at one point in 2016, so one would need substantial purchasing power and would endure significant costs to move the stock in a meaningful way.<sup>282</sup> Instead of manipulating the market for Alphabet shares, one could manipulate the trading of those shares on a particular dark pool or exchange during a very short period of time using various methods like spoofing, electronic front running, or wash trading. As such, financial intermediaries serve as key arenas for market manipulation.

To better combat market manipulation that frequently originates at the intermediary level, policymakers should adopt the organizing principle of intermediary integrity. This principle, as introduced here, advocates for intermediary practices that favor private supervision, investor neutrality, enhanced security, and fair access in its conduct with counterparties and other market participants. This principle, in practice, would disfavor conduct that

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<sup>278</sup> See Yadav, *supra* note 262, at 1090–94 (advocating for empowering exchanges to better help regulate financial markets).

<sup>279</sup> Tom C.W. Lin, *Infinite Financial Intermediation*, 50 WAKE FOREST L. REV. 643, 661 (2015).

<sup>280</sup> See Gary Gorton & Andrew Winton, *Financial Intermediation*, in 1A HANDBOOK OF THE ECONOMICS OF FINANCE: CORPORATE FINANCE 431, 433 (George M. Constantinides, Milton Harris & René M. Stulz eds., 2003) (“Financial intermediation is a pervasive feature of all of the world’s economies.”); Kathryn Judge, *Intermediary Influence*, 82 U. CHI. L. REV. 573, 614–24 (2015) (discussing the influential role of financial intermediaries in the marketplace).

<sup>281</sup> See BENTON E. GUP, BANKING AND FINANCIAL INSTITUTIONS: A GUIDE FOR DIRECTORS, INVESTORS, AND COUNTERPARTIES 23–24 (2011) (defining the essential roles of financial intermediation in modern finance).

<sup>282</sup> See Jonathan Taplin, *Forget AT&T. The Real Monopolies Are Google and Facebook*, N.Y. TIMES (Dec. 13, 2016), [https://www.nytimes.com/2016/12/13/opinion/forget-att-the-real-monopolies-are-google-and-facebook.html?\\_r=0](https://www.nytimes.com/2016/12/13/opinion/forget-att-the-real-monopolies-are-google-and-facebook.html?_r=0) [<https://perma.cc/55NU-Q5V5>]; Verstein, *supra* note 174, at 220 (“[M]anipulative trading entails substantial costs and risks for the manipulator.”).

grants certain market participants special access to the order flows of other participants, permits unfair execution of trades, or allows relaxed security protocols for certain market participants. This principle, in practice, would also encourage intermediaries to adopt new technologies to combat market manipulation within their respective purviews, which can facilitate competitive private ordering solutions to better address the emerging dangers of cybernetic market manipulation.

The fact that this principle emphasizes regulation at the intermediary level to combat a new mode of market manipulation, which empowers private regulators and entities, is not a radical departure from existing practice since exchanges and self-regulating organizations have historically played important regulatory roles in the financial marketplace.<sup>283</sup> Financial regulators already require reasonable and diligent supervision by financial intermediaries.<sup>284</sup> Moreover, in response to new threats and new regulation in the marketplace, many financial firms already invest substantial resources in compliance, technology, and cybersecurity.<sup>285</sup> As such, rather than a radical deviation from existing practice, this principle empowers and updates the existing practice to minimize regulatory disruption to the financial markets.

The legal principle of financial intermediary integrity has similar, though not symmetrical, counterparts in the analog world of traditional banking and the digital world of cyberspace. First, the principle of intermediary integrity is akin to the principle of fair lending from the analog world of traditional banking. Similar to how the principle of fair lending seeks to ensure equitable access for all parties when dealing with banking institutions,<sup>286</sup> the principle of intermediary integrity seeks to ensure honest conduct by market participants who transact via a financial intermediary. Second, the principle of intermediary integrity also has parallels with the principle of net neutrality from the digital world of cyberspace.<sup>287</sup> Just as the principle of net neutrality seeks to safeguard

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<sup>283</sup> See Birdthistle & Henderson, *supra* note 132, at 12–24; Karmel, *supra* note 132, at 151–55; see also Rory Van Loo, *Rise of the Digital Regulator*, 66 DUKE L.J. 1267, 1318–19 (2017) (discussing how private intermediaries can serve as important regulators in more digitized marketplace).

<sup>284</sup> See, e.g., 15 U.S.C. § 78o(b)(4)(E) (2012) (requiring reasonable supervision of broker-dealers); 17 C.F.R. § 166.3 (2017) (“Each . . . registrant, except an associated person who has no supervisory duties, must diligently supervise the handling by its partners, officers, employees and agents . . .”).

<sup>285</sup> Tom C.W. Lin, *Compliance; Technology; and Modern Finance*, 11 BROOK. J. CORP. FIN. & COM. L. 159, 164–68, 177–78 (2016).

<sup>286</sup> See COMPTROLLER OF THE CURRENCY, COMPTROLLER’S HANDBOOK: FAIR LENDING 3–7 (2010) (cataloging federal fair lending laws and regulations).

<sup>287</sup> See TIM WU, THE MASTER SWITCH: THE RISE AND FALL OF INFORMATION EMPIRES 202 n.\* (2010) (“The ideal of neutrality bespeaks a network that treats all it carries equally, indifferent to the nature of the content or

fair entry and fair play on the Internet, the principle of intermediary integrity seeks to safeguard the credibility and reliability of financial markets.

The principle of intermediary integrity, as introduced here, is a preliminary proposal that is meant to serve as an early organizing concept for policymakers as they confront the challenges posed by new modes of market manipulation with new rules, regulations, and guidance. Policymakers and regulators should work with key market stakeholders to develop detailed rules and guidelines using the principle as a North Star to address the complexities surrounding market manipulation.<sup>288</sup> It is understood that much of the difficulties of addressing market manipulation lie in the actual drafting, passage, implementation, execution, and enforcement of new rules and regulations. Nevertheless, the organizing principle of intermediary integrity can serve as an important guidepost for creating a better regulatory framework to combat the new forms market manipulation.

### *B. Financial Cybersecurity*

The emergence of cybernetic market manipulation would result in greater and more urgent emphasis on financial cybersecurity, since the new methods of manipulation frequently leverage cyber means for devious ends. For instance, many pernicious schemes of mass misinformation manipulation are hatched and launched in cyberspace.<sup>289</sup> Furthermore, because much of today's financial marketplace operates on a linked, privately held cyberspace infrastructure, policymakers and regulators should design policies that encourage financial institutions to improve their cybersecurity in a timelier manner.<sup>290</sup>

The modern financial marketplace is truly a high-tech marketplace where many of the key operations and transactions occur in electronic networks of cyberspace.<sup>291</sup> As such, attempts at disrupting and manipulating the marketplace often happen in cyberspace by authorized and unauthorized parties.<sup>292</sup> The marketplace has suffered through multiple attempts at market manipulation by

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the identity of the user . . . [t]he neutrality principle holds that the big decisions concerns how to use the medium are best left to the 'ends' of the network, not the carriers of information.”)

<sup>288</sup> See Thel, *supra* note 270, at 280 (encouraging cautious legal interventions for the complex problems associated with market manipulation).

<sup>289</sup> See *supra* Part III.B.3.

<sup>290</sup> See Kristen E. Eichensehr, *The Cyber-Law of Nations*, 103 GEO. L.J. 317, 350–51 (2015) (“[P]rivate parties own the majority of the underlying infrastructure that supports the cyber domain.”).

<sup>291</sup> See, e.g., PATTERSON, *supra* note 2, at 8–10.

<sup>292</sup> See, e.g., Tom C.W. Lin, *Financial Weapons of War*, 100 MINN. L. REV. 1377, 1405–08 (2016) (highlighting the threats of “cyber financial weapons”).

foreign states and cyber criminals in the last few years alone.<sup>293</sup> For instance, a massive global cyberattack using ransomware in the spring of 2017 affected thousands of organizations and businesses around the world including financial institutions and securities markets in China.<sup>294</sup> To combat these disruptive actions and the new modes of market manipulation, greater emphasis needs to be placed on financial cybersecurity.<sup>295</sup> Because much of the technological infrastructure of the financial marketplace is linked, privately held and operated, policymakers, regulators, and private firms all need to work better in a concerted fashion to enhance financial cybersecurity and guard against cybernetic market manipulation.<sup>296</sup> Good cybersecurity requires that all firms and counterparties in the marketplace have strong cybersecurity safeguards in place. It is simply not enough for a firm to have strong cybersecurity capabilities while its counterparties and vendors are vulnerable.

Recent efforts like the jointly proposed improved cybersecurity standards from the Federal Reserve, the Federal Deposit Insurance Corporation, and the Office of the Comptroller of the Currency, would help move to enhance cybersecurity in the financial marketplace.<sup>297</sup> Additionally, regulatory innovations like the National Cyber-Forensics & Training Alliance—established by the Federal Bureau of Investigation to marshal government resources and expertise with those of the private sector to combat the cybersecurity threats—

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<sup>293</sup> See VENGERIK ET AL., *supra* note 212, at 3; Nicole Perloth & Quentin Hardy, *Bank Hacking Was the Work of Iranians, Officials Say*, N.Y. TIMES (Jan. 8, 2013), <http://www.nytimes.com/2013/01/09/technology/online-banking-attacks-were-work-of-iran-us-officials-say.html> [<https://perma.cc/7TK3-A3BK>]; Riley, *supra* note 217, at 40; David E. Sanger, David Barboza & Nicole Perloth, *Chinese Army Unit Is Seen as Tied to Hacking Against U.S.*, N.Y. TIMES (Feb. 18, 2013), <http://www.nytimes.com/2013/02/19/technology/chinas-army-is-seen-as-tied-to-hacking-against-us.html> [<https://perma.cc/4TLA-6WYG>].

<sup>294</sup> Gerry Mullany & Paul Mozur, *Cyberattacks Spreads in Asia; Thousands of Groups Affected*, N.Y. TIMES (May 15, 2017), <https://www.nytimes.com/2017/05/15/world/asia/china-cyberattack-hack-ransomware.html> [<https://perma.cc/75Y9-MFPW>].

<sup>295</sup> See Sarah Bloom Raskin, Deputy Sec’y U.S. Dep’t Treasury, Remarks at the Harvard Law School Forum on Corporate Governance and Financial Regulation: Protecting Financial Cyberspace (Dec. 16, 2016), <https://corpgov.law.harvard.edu/2016/12/16/protecting-financial-cyberspace/>.

<sup>296</sup> See, e.g., SHANE HARRIS, @WAR: THE RISE OF THE MILITARY-INTERNET COMPLEX xxii (2014) (“Defending computer networks, and launching attacks on them, requires the participation, willing or otherwise, of the private sector.”); Nathan Alexander Sales, *Regulating Cyber-Security*, 107 NW. U. L. REV. 1503, 1550–52 (2013) (discussing the use of carrots and sticks to improve cybersecurity); Bruce P. Smith, *Hacking, Poaching, and Counterattacking: Digital Counterstrikes and the Contours of Self-Help*, 1 J.L. ECON. & POL’Y 171, 173 (2005); Christopher S. Yoo, *Cyber Espionage or Cyberwar?: International Law, Domestic Law, and Self-Protective Measures*, in CYBERWAR: LAW & ETHICS FOR VIRTUAL CONFLICTS 175, 192–93 (Jens David Ohlin, Kevin Govern & Claire Finkelstein eds., 2015) (highlighting the need for “improved software engineering”).

<sup>297</sup> Dept. of Treasury, Office of the Comptroller et al., Enhanced Cyber Risk Management Standards (Oct. 19, 2016), <https://www.federalreserve.gov/newsevents/pressreleases/files/bcreg20161019a1.pdf>.

serve as a good model for future joint efforts between the public and private sectors.<sup>298</sup>

Thoughtful government actions in cybersecurity is needed as a pure market-based approach may be inadequate because private firms are frequently motivated by profit-making and expense reduction and lack proper incentives to invest and upgrade their cybersecurity capabilities in a proactive, timely manner.<sup>299</sup> While some firms have been making significant investments in cybersecurity, many have not.<sup>300</sup> Furthermore, to the extent improvements are made, they are often done in a reactionary, firm-by-firm manner following some major security breach—in other words, in response to the last threat and not the next threat.<sup>301</sup> Therefore, public policy will need to be better leveraged to provide stronger incentives to address the market's shortcomings related to financial cybersecurity, and to encourage further innovation in emerging technologies, like blockchains, to better protect the marketplace.<sup>302</sup>

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<sup>298</sup> See NATIONAL CYBER-FORENSICS & TRAINING ALLIANCE, <https://www.ncfta.net/> (last visited Jan. 27, 2017); Nicole Hong, *Private-Public Collaboration Puts Pittsburgh at Fore of Cybercrime Fight*, WALL ST. J. (Aug. 13, 2015, 7:30 PM), <http://www.wsj.com/articles/private-public-collaboration-puts-pittsburgh-at-fore-of-cybercrime-fight-1439508624> [<https://perma.cc/B9SP-8C9U>].

<sup>299</sup> See, e.g., STEWART BAKER, SHAUN WATERMAN & GEORGE IVANOV, MCAFEE, IN THE CROSSFIRE: CRITICAL INFRASTRUCTURE IN THE AGE OF CYBER WAR 14 (2010); NY STATE DEPT. OF FIN. SERVS., REPORT ON CYBER SECURITY IN THE BANKING SECTOR 11 (2014) (highlighting resource constraints and stale software as ongoing challenges for financial cybersecurity); Derek E. Bambauer, *Ghost in the Network*, 162 U. PA. L. REV. 1011, 1036 (2014) (“Rational vendors will accordingly skimp on security investments, at least at the margins, since they will likely not be able to recover those costs via higher prices that correlate with higher quality.”); Nicole Perlroth, *Hacked vs. Hackers: Game On*, N.Y. TIMES (Dec. 2, 2014, 9:31 PM), [https://bits.blogs.nytimes.com/2014/12/02/hacked-vs-hackers-game-on/?mtrref=www.google.com&gwh=9AFA0DE127E6E327C29F32D15D18F29D&gwt=pay&assetType=nyt\\_now](https://bits.blogs.nytimes.com/2014/12/02/hacked-vs-hackers-game-on/?mtrref=www.google.com&gwh=9AFA0DE127E6E327C29F32D15D18F29D&gwt=pay&assetType=nyt_now) [<https://perma.cc/S4YB-R7A6>] (reporting on the lack of urgency regarding cybersecurity).

<sup>300</sup> See, e.g., JOEL BRENNER, AMERICA THE VULNERABLE: INSIDE THE NEW THREAT MATRIX OF DIGITAL ESPIONAGE, CRIME, AND WARFARE 239 (2011) (discussing the underinvestment in cybersecurity by American businesses); JPMORGAN CHASE & CO., ANNUAL REPORT 2014, at 142 (2015) (“In 2014, the Firm spent more than \$250 million, and had approximately 1,000 people focused on cybersecurity efforts, and these efforts are expected to grow significantly over the coming years.”).

<sup>301</sup> See, e.g., Daniel Huang, Emily Glazer & Danny Yadron, *Financial Firms Bolster Cybersecurity Budgets*, WALL ST. J. (Nov. 17, 2014, 1:05 PM), <https://www.wsj.com/articles/financial-firms-bolster-cybersecurity-budgets-1416182536> [<https://perma.cc/EGP8-8H79>]; Jessica Silver-Greenberg & Matthew Goldstein, *After JPMorgan Chase Breach, Push to Close Wall St. Security Gaps*, N.Y. TIMES (Oct. 21, 2014, 4:57 PM), <https://dealbook.nytimes.com/2014/10/21/after-jpmorgan-cyberattack-a-push-to-fortify-wall-street-banks/> [<https://perma.cc/AD47-MF2A>].

<sup>302</sup> See DON TAPSCOTT & ALEX TAPSCOTT, BLOCKCHAIN REVOLUTION: HOW THE TECHNOLOGY BEHIND BITCOIN IS CHANGING MONEY, BUSINESS, AND THE WORLD 39–41 (2016) (discussing the security benefits of blockchain technology for financial firms).

The federal government could utilize various policy tools to incentivize private financial firms to improve their cybersecurity in a more proactive manner.<sup>303</sup> Tax law, for instance, if properly calibrated, can encourage institutions in the financial industry to enhance their cyber defenses in a timely manner. Through a combination of tax credits, bonus depreciation, and increased deductions, policymakers can incentivize the replacement of outdated, vulnerable information systems and a greater investment in better, more secure systems.<sup>304</sup> Following the recent financial crisis, policymakers used similar tax policies to stimulate private businesses towards accelerating and enlarging capital investments to help jumpstart economic activity.<sup>305</sup> Furthermore, in addition to the tools of tax policy, the federal government can also use its large procurement powers to enhance financial cybersecurity and guard against market manipulation.<sup>306</sup> For instance, the federal government can drastically improve financial cybersecurity by expressing contracting preferences for financial institutions that meet certain cybersecurity benchmarks, which would be continually monitored and updated over time.<sup>307</sup> As one of the world's largest purchasers of goods and services, the federal government's contracting preferences could lead to significant cybersecurity improvements at key financial firms and generally in the financial marketplace.<sup>308</sup> It should be noted that the federal government already imposes certain cybersecurity requirements for many of its vendors, but it can certainly do more to enhance its cybersecurity requirements to reflect the latest threats in the marketplace.<sup>309</sup>

In sum, the need for better and more vigilant financial cybersecurity will be one of the key implications of cybernetic market manipulation. Policymakers

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<sup>303</sup> Derek E. Bambauer, *Schrödinger's Cybersecurity*, 48 U.C. DAVIS L. REV. 791, 848–50 (2015).

<sup>304</sup> See, e.g., GARY GUENTHER, CONG. RESEARCH SERV., RL31852, THE SECTION 179 AND BONUS DEPRECIATION EXPENSING ALLOWANCES: CURRENT LAW AND ISSUES FOR THE 114TH CONGRESS (2015), <https://fas.org/sgp/crs/misc/RL31852.pdf>; JANE G. GRAVELLE, CONG. RESEARCH SERV., R43432, BONUS DEPRECIATION: ECONOMIC AND BUDGETARY ISSUES (2014), <https://fas.org/sgp/crs/misc/R43432.pdf>; INTERNAL REVENUE SERV., PUB. NO. 946, HOW TO DEPRECIATE PROPERTY 3–24 (2013); James M. Williamson & John L. Pender, *Economic Stimulus and the Tax Code: The Impact of the Gulf Opportunity Zone*, 44 PUB. FIN. REV. 415 (2014).

<sup>305</sup> See Consolidated Appropriations Act 2016, Pub. L. No. 114-113, 129 Stat. 2242, 3040 (2015); Tax Increase Prevention Act of 2014, Pub. L. No. 113-295, 128 Stat. 4010 (2014).

<sup>306</sup> See, e.g., Daniel P. Gitterman, *The American Presidency and the Power of the Purchaser*, 43 PRESIDENTIAL STUD. Q. 225, 225–29 (2013).

<sup>307</sup> See Bambauer, *supra* note 303, at 1062–63.

<sup>308</sup> See *id.*; Gitterman, *supra* note 306, at 225–29.

<sup>309</sup> See Implementation of Information Technology Security Provision, 77 Fed. Reg. 749, 750–51 (Jan. 6, 2012) (codified at 48 C.F.R. pts. 501, 539, 552); *Improving Cybersecurity Protections in Federal Acquisitions*, OFF. FED. CHIEF INFO. OFFICER, <https://policy.cio.gov/cybersecurity-protections-in-federal-acquisitions/> (last visited Mar. 17, 2017).

and regulators must thoughtfully and creatively use various tools at their disposal to encourage private firms to take a more proactive and timely posture to improve financial cybersecurity so as to guard against the emerging threats of cybernetic market manipulation.

### C. *Investment Strategies*

A key implication of the emergence of the new modes of market manipulation could likely be a significant withdrawal of ordinary investors from a marketplace they perceive to be rigged and manipulated to privilege other types of investors in the marketplace.<sup>310</sup> *Flash Boys*, the Flash Crash, and other recent market events have dispelled any notion that the stock market is a stable, level playing field for all investors. Its message runs contrary to the pronouncements and intimations of regulators over the years.<sup>311</sup> Polling and commentary in recent years have suggested that confidence in the fairness of equity markets among Americans has dropped significantly.<sup>312</sup> Nevertheless, ordinary investors still make up a significant fraction of the investor population.<sup>313</sup>

Instead of withdrawing from directly investing in the marketplace entirely, ordinary investors seeking better returns should adopt a boring, low-cost, low-speed investment strategy in the new high-tech, high-speed financial marketplace.<sup>314</sup> To best maximize their long-term returns in this turbulent, high-tech marketplace, ordinary investors should invest via low-fee index funds, exchange-traded funds, or mutual funds that track the broad marketplace. This straightforward investment advice is not novel or original; famed investors like John Bogle, Warren Buffett, and Burton Malkiel have been advocating this

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<sup>310</sup> See, e.g., Tom C.W. Lin, *Reasonable Investor(s)*, 95 B.U. L. REV. 461 (2015) (surveying the various types of investors in the marketplace).

<sup>311</sup> See Selective Disclosure and Insider Trading, Securities Act Release No. 33-7881, 65 Fed. Reg. 51,715, 51,715 (Aug. 24, 2000) (suggesting that all investors should be on a “level playing field with market insiders”); Hu, *supra* note 52, at 840–42 (discussing how the SEC encourages investments in the stock market); Donald C. Langevoort, *The SEC, Retail Investors, and the Institutionalization of the Securities Markets*, 95 VA. L. REV. 1025, 1026 (2009) (discussing regulatory efforts to “level the playing field between the meek and the privileged”); Lauren E. Willis, *Against Financial-Literacy Education*, 94 IOWA L. REV. 197, 272–75 (2008).

<sup>312</sup> Fox, Glostén & Rauterberg, *supra* note 7, at 194.

<sup>313</sup> See U.S. CENSUS BUREAU, U.S. DEP’T OF COMMERCE, STATISTICAL ABSTRACT OF THE UNITED STATES 2012, at 746 t.1201 (131st ed. 2012), <http://www2.census.gov/library/publications/2011/compendia/statab/131ed/2012-statab.pdf>; Alicia Davis Evans, *A Requiem for the Retail Investor*, 95 VA. L. REV. 1105, 1117 (2009) (“[R]etail investor market participation, though declining relative to that of institutions, is growing on an absolute basis.”).

<sup>314</sup> RICHARD FERRI, *THE POWER OF PASSIVE INVESTING: MORE WEALTH WITH LESS WORK*, at x–xviii (2011).

approach for years.<sup>315</sup> Fortunately, in recent years, more and more investors have been moving their money into passive funds.<sup>316</sup> Nevertheless, though it may seem straightforward and simple, many ordinary investors still lose billions of dollars each year trying to beat the market. The emergence of new modes of market manipulation may make it even harder for ordinary investors to directly compete in the market on a short-term, hour-to-hour or day-to-day basis.

Even in the absence of traditional and new forms of market manipulation, there exists a significant discord between the myth and the reality of the financial marketplace that paints a very unfavorable outlook for ordinary investors. In theory, every investor has the same opportunity to compete for positive returns in a well-regulated, efficient, and fair marketplace.<sup>317</sup> This is because in the theoretical realm of efficient capital markets, there are no meaningful differences between ordinary investors and more sophisticated investors like the high-frequency traders, since everyone is equally rational and capable.<sup>318</sup> In reality, ordinary investors can be incredibly unskilled and obtuse when compared to sophisticated investors like high-frequency traders.<sup>319</sup> Furthermore, even if ordinary investors were as skilled and informed as their sophisticated counterparts, the sophisticated investors with better resources would be able to execute their trades faster than ordinary investors.<sup>320</sup> As such, ordinary investors trading from their laptops should not reasonably expect to compete with investors that have better technology and better information. Numerous studies

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<sup>315</sup> See, e.g., BURTON G. MALKIEL, *A RANDOM WALK DOWN WALL STREET: THE TIME-TESTED STRATEGY FOR SUCCESSFUL INVESTING* 399–401 (2012); Letter from Warren E. Buffett, Chairman of the Bd., Berkshire Hathaway Inc., to Berkshire Hathaway Shareholders 23–25 (Feb. 25, 2017), <http://www.berkshirehathaway.com/letters/2016ltr.pdf>.

<sup>316</sup> Sarah Krouse et al., *Why Passive Investing Is Overrunning Active, in Five Charts*, WALL ST. J. (Oct. 17, 2016, 10:30 AM), <http://www.wsj.com/graphics/passive-investing-five-charts/?mod=wsjapp> [<https://perma.cc/7N6L-HK6N>].

<sup>317</sup> See, e.g., Eugene F. Fama & James D. MacBeth, *Long-Term Growth in a Short-Term Market*, 29 J. FIN. 857, 859 & n.7 (1974) (positing that investors theoretically have “homogenous expectations”).

<sup>318</sup> See, e.g., Merton H. Miller, *The History of Finance*, 25 J. PORTFOLIO MGMT., Summer 1999, at 95, 97 (explaining modern portfolio theory’s presumption that “investors all share the same expectations as to returns, variances, and covariances”).

<sup>319</sup> See Shlomo Benartzi & Richard H. Thaler, *Naive Diversification Strategies in Defined Contribution Saving Plans*, 91 AM. ECON. REV. 79 (2001) (finding poor investment practices by ordinary investors); Jill E. Fisch & Tess Wilkinson-Ryan, *Why Do Retail Investors Make Costly Mistakes? An Experiment on Mutual Fund Choice*, 162 U. PA. L. REV. 605, 606 (2014) (“Mounting evidence demonstrates that retail investors make predictable, costly mistakes.”).

<sup>320</sup> See Fabozzi, Focardi & Jonas, *supra* note 104, at 10 (highlighting the advantages of faster execution speed in the marketplace); Matthew Baron, Jonathan Brogaard & Andrei Kirilenko, *The Trading Profits of High Frequency Traders* (Nov. 2012) (unpublished manuscript), [conference.nber.org/confer/2012/MMf12/Baron\\_Brogaard\\_Kirilenko.pdf](http://conference.nber.org/confer/2012/MMf12/Baron_Brogaard_Kirilenko.pdf).

suggest that ordinary investors should not be trying to pick winners and losers in the stock market.<sup>321</sup> Simply put, ordinary investors should not expect extraordinary returns from the marketplace.

Graphically, based on a chart from the prominent investment management firm BlackRock, the dismal long-term returns of actively managed investments by ordinary investors relative to other investment strategies focused on stocks, bonds, gold, international stocks, homes, oil, and inflation is quite stark<sup>322</sup>:

Table 1: Returns of Average Investors Relative to Other Asset Classes (1996–2015)



Rather than using short-term strategies, ordinary investors should adopt a passive, long-term, low-cost investment strategy. To maximize their long-term returns, investors should invest in low-fee index funds and mutual funds that track the broad marketplace using benchmarks like the S&P 500 and the Russell 2000 indexes.<sup>323</sup> Modern portfolio theory suggests that market-wide diversification along with low transaction fees would permit investors to reduce their risk exposure and maximize the benefits of compounding returns over the

<sup>321</sup> See, e.g., Brad M. Barber & Terrance Odean, *Trading Is Hazardous to Your Wealth: The Common Stock Investment Performance of Individual Investors*, 55 J. FIN. 773, 785–88 (2000); Andrea Frazzini & Owen A. Lamont, *Dumb Money: Mutual Fund Flows and the Cross-Section of Stock Returns*, 88 J. FIN. ECON. 299, 319 (2008) (“[I]ndividual investors have a striking ability to do the wrong thing.”); Ronald C. Lease, Wilbur G. Lewellen & Gary G. Scharbaum, *The Individual Investor: Attributes and Attitudes*, 29 J. FIN. 413, 429–31 (1974); Don A. Moore et al., *Positive Illusions and Forecasting Errors in Mutual Fund Investment Decisions*, 79 ORG. BEHAV. & HUM. DECISION PROCESSES 95, 110–12 (1999); Felix Salmon, *Stop Selling Bonds to Retail Investors*, 35 GEO. J. INT’L L. 837, 837 (2004).

<sup>322</sup> *Investing and Emotions, How the Average Investor Stacks Up*, BLACKROCK, <https://www.blackrock.com/investing/literature/investor-education/investing-and-emotions-one-pager-va-us.pdf> (last visited Sept. 11, 2016).

<sup>323</sup> See, e.g., JOHN C. BOGLE, *THE LITTLE BOOK OF COMMON SENSE INVESTING: THE ONLY WAY TO GUARANTEE YOUR FAIR SHARE OF STOCK MARKET RETURNS* 45–53 (2007).

long term.<sup>324</sup> In fact, ample evidence over the years indicates this passive approach is the method most likely to generate the best returns for most investors over a long-term period measured in years and decades, not hours and days.<sup>325</sup> Investing is not necessarily an endeavor that rewards the swiftest and most active participant. The good-tempered and patient investor frequently does well over the long run. Furthermore, as more cybernetic market manipulation methods emerge to facilitate short-term marketplace distortions, a long-term passive approach is immune from such short-term manipulations. A long-term, passive investor has little to fear of pinging, spoofing, wash trading, or mass misinformation since those short-term manipulations generally do little or nothing to the long run valuation of a company.<sup>326</sup> It is important to note that a wholesale shift of capital from most investors in the marketplace to passive funds could have profound implications on market dynamics and corporate governance.<sup>327</sup> That said, until those implications manifest and prove to be deleterious to investors, this recommendation remains sage advice for most ordinary investors.

In sum, the emergence of new cybernetic modes of market manipulation may discourage many ordinary investors from directly participating in a marketplace that they perceived to be rigged against them. Instead of withdrawing entirely from directly investing in the marketplace, more ordinary investors should adopt a boring, low-cost, passive investment strategy that favors sustainable long-term value over quick short-term gains, as many of their peers have already begun to do so.

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<sup>324</sup> See IAN AYRES & BARRY NALEBUFF, *LIFECYCLE INVESTING: A NEW, SAFE, AND AUDACIOUS WAY TO IMPROVE THE PERFORMANCE OF YOUR RETIREMENT PORTFOLIO* 1–3 (2010) (highlighting the importance of investment diversification); Nicolas P.B. Bollen & Jeffrey A. Busse, *Short-Term Persistence in Mutual Fund Performance*, 18 REV. FIN. STUD. 569, 594–95 (2005) (advocating for “a naive buy-and-hold approach”); Edwin J. Elton & Martin J. Gruber, *Modern Portfolio Theory, 1950 to Date*, 21 J. BANKING & FIN. 1743, 1744 (1997); Harry Markowitz, *Portfolio Selection*, 7 J. FIN. 77, 87–91 (1952); Leo E. Strine, Jr., *Can We Do Better by Ordinary Investors? A Pragmatic Reaction to the Dueling Ideological Mythologists of Corporate Law*, 114 COLUM. L. REV. 449, 480–82 (2014) (discussing how index funds and mutual funds can protect ordinary investors).

<sup>325</sup> See LARRY E. SWEDROE, KEVIN GROGAN & TIYA LIM, *THE ONLY GUIDE YOU’LL EVER NEED FOR THE RIGHT FINANCIAL PLAN: MANAGING YOUR WEALTH, RISK, AND INVESTMENTS* 82–93 (2010) (summarizing evidence supporting passive investing); Ben Hall, *The Importance of Asset Allocation and ETFs*, 4 J. INDEX INVESTING 24 (2013); Burton G. Malkiel, *Returns from Investing in Equity Mutual Funds 1971 to 1991*, 50 J. FIN. 549 (1995).

<sup>326</sup> See BENJAMIN GRAHAM, *THE INTELLIGENT INVESTOR: A BOOK OF PRACTICAL COUNSEL* 477 (2006).

<sup>327</sup> Sarah Krouse, David Benoit & Tom McGinty, *Meet the New Corporate Power Brokers: Passive Investors*, WALL ST. J. (Oct. 24, 2016, 10:41 AM), <https://www.wsj.com/articles/the-new-corporate-power-brokers-passive-investors-1477320101> [<https://perma.cc/YST8-4YDH>].

### CONCLUSION

In a rapidly evolving financial marketplace, the new methods of cybernetic market manipulation will pose some of the most vexing challenges for policymakers and regulators in the coming years. The emergence of market manipulation methods that leverage new financial technology, electronic communications, and information systems to unfairly privilege the few at the expense of the many will threaten the very integrity and credibility of our financial markets. Every investor and institution could be at risk of suffering direct and indirect losses.

This Article identifies and explores the forthcoming challenges posed by the new financial marketplace and the emerging efforts to manipulate it. It offers an original examination of the new forms of market distortions that it terms cybernetic market manipulation, explains the potential damage of these disruptive actions on the marketplace, and recommends pragmatic policies to better protect investors and safeguard financial markets from manipulation. Throughout its analysis, this Article is aware of the demands of regulating a rapidly evolving financial marketplace, but it is also mindful of the need for swift and thoughtful action against the looming threats to distort the marketplace. In the end, this Article hopes to serve as an early, working framework for thinking and acting with urgency about our new financial reality and the new market manipulation.