THE NEW MARKET MANIPULATION

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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, pinging, 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.¹ 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.² 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.³

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.⁴

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. 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.”

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. First, it aims to provide a cogent,

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


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. 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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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.\(^9\) 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 \textit{Flash Boys} to the larger sea change occurring in the financial markets. It explains why the Flash Crash and \textit{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, pinging, 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.\(^{10}\) 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

\(^9\) \textsc{Lewis, supra note 8, at 34, 79, 89, 226}.

\(^{10}\) See, \textit{e.g.}, Shaun D. Ledgerwood & Paul R. Carpenter, \textit{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.\textsuperscript{11} The second event was the publication of Michael Lewis’s book, \textit{Flash Boys}, on March 31, 2014.\textsuperscript{12} Both events establish an early foundation and shed insightful light for better understanding the evolution of modern markets and market manipulation.

\textsuperscript{11} CFTC & SEC FINDINGS, supra note 8, at 1.

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. 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. 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. In the span of less than thirty very volatile minutes, approximately $1 trillion in market value vanished from the U.S. stock market. 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. Following the precipitous decline, the market began to rebound rapidly, recovering the bulk of the losses. The volatile trading session of May 6, 2010, is now simply referred to as the Flash Crash.

Following the Flash Crash, the SEC and CFTC initiated a joint investigation and issued a report on September 30, 2010, about their findings. According to the report, the Flash Crash was likely initiated by a futures order from Waddell & Reed, a Kansas mutual fund company. 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. 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. 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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13 CFTC & SEC FINDINGS, supra note 8, at 1.
14 Id. at 9.
15 Id.
17 CFTC & SEC FINDINGS, supra note 8, at 1.
18 Id. at 9.
19 Bowley, supra note 3.
20 See CFTC & SEC FINDINGS, supra note 8.
21 Id. at 2; Bowley, supra note 3.
22 CFTC & SEC FINDINGS, supra note 8, at 2.
23 Id.
dropped and for however long it took to fulfill the order.\textsuperscript{24} The entire order was fulfilled in about twenty minutes.\textsuperscript{25} In years past, because of technological limitations, an order of this size would have normally taken several hours or days to complete.\textsuperscript{26}

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.\textsuperscript{27} Within twenty minutes after Waddell \& Reed’s initial trade, S\&P futures experienced a 3\% drop,\textsuperscript{28} and the Dow Jones Industrial Average (Dow) experienced a 9.16\% drop, which amounted to nearly 1000 points.\textsuperscript{29} 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.\textsuperscript{30} Shares of Accenture, a leading consulting company, plummeted by over 99\%, from $40 to $0.01.\textsuperscript{31} On the flipside, shares of Sotheby’s, the famed auction house, increased three thousand-fold, from $34 to $99,999.99.\textsuperscript{32} 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.\textsuperscript{33}

The turbulent last few hours of the trading day on May 6, 2010, resembled a rollercoaster ride with trillions of dollars at stake. The \textit{Wall Street Journal} visually summarized the Flash Crash as follows:\textsuperscript{34}

\begin{itemize}
  \item \textsuperscript{24} Bowley, supra note 3.
  \item \textsuperscript{25} CFTC \& SEC FINDINGS, supra note 8, at 2.
  \item \textsuperscript{26} See id.
  \item \textsuperscript{27} Id. at 3.
  \item \textsuperscript{28} Id.
  \item \textsuperscript{29} See David M. Serritella, \textit{High Speed Trading Begets High Speed Regulation: SEC Response to Flash Crash, Rash}, 2010 U. ILL. J.L. TECH. \& POL’y 433, 435.
  \item \textsuperscript{30} CFTC \& SEC FINDINGS, supra note 8, at 84–85.
  \item \textsuperscript{31} Id. at 83; Haldane, supra note 16.
  \item \textsuperscript{32} Haldane, supra note 16.
  \item \textsuperscript{33} CFTC \& SEC FINDINGS, supra note 8, at 1.
\end{itemize}
Ultimately, the SEC and CFTC joint inquiry did not blame the Flash Crash on manipulative conduct or illegal behavior. 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.” 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.

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. Sarao was charged by the
Department of Justice (DOJ) for criminal violations as well as by the CFTC for civil violations.39

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.”40

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.41 Specifically, he allegedly manipulated the market for E-Mini S&P 500 futures contracts being traded on the Chicago Mercantile Exchange.42 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.43

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.44

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

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

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40 Futures Trader, supra note 38.
42 Id.
43 Id.
44 Id.
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. 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. 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.

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47 For a discussion of the post-Flash Crash regulatory actions, see infra Part II.B.


49 See Kaufman & Levin, supra note 48 (“Algorithmic 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.50

There is a popular perception that the stock market is a transparent and fair human endeavor.51 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.52

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.53 First, instead of humans, automated machines communicating through high-speed spectra and cables operate much of the marketplace.54 In fact, in the United States today, powerful supercomputers running high-frequency algorithmic programs, devoid of human

50 *Lewis*, supra note 8, at 3.
51 Id. at 9, 40.
53 *Lewis*, supra note 8, at 9–10, 40.
assistance, conduct most equity trading.\textsuperscript{55} 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.\textsuperscript{56} 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.\textsuperscript{57} According to Lewis, “[i]nside a dark pool, no one but the broker who ran it had any idea what was happening.”\textsuperscript{58} 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.\textsuperscript{59} 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.\textsuperscript{60}

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.\textsuperscript{61} This allows their high-speed


\textsuperscript{57} See BRIAN R. BROWN, CHASING THE SAME SIGNALS: HOW BLACK-BOX TRADING INFLUENCES STOCK MARKETS FROM WALL STREET TO SHANGHAI 116 (2010).

\textsuperscript{58} LEWIS, supra note 8, at 43.

\textsuperscript{59} See id. at 70–84.

\textsuperscript{60} Id. at 70–84.

\textsuperscript{61} Id. at 79.
machines to reduce the time it takes to execute a trade by fractions of a second. 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. 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. Then, they would buy the stock you wanted to buy and sell it right back to you at a premium. Lewis likened this predatory practice to front running that exacted a tax on the entire marketplace, amounting to $160 million a day. 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. These firms accounted for half of the trades in the stock market, yet they submitted over 99% of the orders. 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.

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). In his telling, “[w]hat had once been the world’s

62 Id.
64 LEWIS, supra note 8, at 180–85.
65 Id.
66 Id. at 52.
67 Id. at 171.
68 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.”).
69 Id. at 111.
70 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.”71

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.72 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.73 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.74 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.75 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

71 Id. at 69.
72 Id. at 23.
73 Id. at 30.
74 Id. at 49.
75 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.\textsuperscript{76} 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.\textsuperscript{77} 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.\textsuperscript{78} IEX would not permit co-location, special data access, or rebates for orders, and it would charge one rate for all buyers and sellers.\textsuperscript{79} 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,\textsuperscript{80} none have generated the publicity and policy impact of \textit{Flash Boys}.\textsuperscript{81} Following its publication, private litigants, the New York Attorney General, the DOJ, the U.S. Senate, and the SEC all announced initiatives and

\textsuperscript{76} Id. at 50.
\textsuperscript{77} Id. at 49.
\textsuperscript{78} Id. at 164.
\textsuperscript{79} Id. at 173–77.
\textsuperscript{80} 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.
actions to look into trading practices in the U.S. stock market.\textsuperscript{82} Despite its publicity and policy impact, \textit{Flash Boys} was not without its critics. Many observers inside and outside the financial industry thought that \textit{Flash Boys} oversimplified the modern marketplace and unfairly vilified high-frequency traders.\textsuperscript{83} 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.

\section*{II. The New Financial Reality}

The Flash Crash and \textit{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 \textit{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.

\subsection*{A. The New Marketplace}

The Flash Crash and \textit{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 \textit{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.\textsuperscript{84} While the fallout of

\begin{quotation}


\textsuperscript{84} See Tom C.W. Lin, \textit{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. 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. 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.

The transformation of modern finance into cyborg finance touches almost every part of the financial industry. 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. Today, practically every significant financial institution uses some form of advanced artificial intelligence for risk analysis and investment.


86 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.”).


management, two financial tasks that were previously done principally by humans. Hedge funds use autonomous algorithmic software to read newsfeeds, analyze data, and pick stocks to generate consistent positive returns. 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. 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. 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. 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. 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.

90 Gerding, supra note 7, at 130–35.
93 Id.
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. 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. 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.

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,” the growing emphasis on faster financial speed has created the systemic risk of “too fast to save.” 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

97 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 . . . .”).


101 See Lin, supra note 87, at 711–14 (introducing the concept of “too fast to save”).
system before anyone can stop it. 102 During periods of financial tumult and distress, automated programs can exacerbate volatility and reduce liquidity by rapidly eliminating trading positions in the marketplace. 103 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. 104 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. 105 Three years later, in 2011, another trader at UBS, a leading Swiss investment bank, caused losses of $2.3 billion. 106 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. 107 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.” 108 In the new financial marketplace, institutions, industries, and instruments are all intermediated and interconnected like never before in a single high-tech financial network. 109

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103 PARTNOY, supra note 98, at 43.


108 See Lin, supra note 87, at 714–16 (introducing the concept of “too linked to fail”).

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. A further complication is the fact that many interconnected financial participants in the new marketplace engage in similar and interdependent strategies. 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. 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.

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. As such, “normal financial accidents” will become more common as the financial markets grow more reliant on complex, high-tech systems. In the last few years, both the New York Stock Exchange and the NASDAQ experienced serious technical


113 See supra Part I.A.1.
glitches that halted trading for several hours during otherwise normal trading days. 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. 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. 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.”

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.


118 See, e.g., Chozick & Perlroth, supra note 48; Goldstein, supra note 3.

119 Albanese, supra note 117.

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. 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. 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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fragmented and technologically driven by disparate electronic systems. 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. 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. 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. 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.

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. 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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124 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).
125 See, e.g., White, supra note 82.
128 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 2016.129 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.130 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.131 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.132 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.133 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.134 In contrast to pure public regulation, which can be slow and blunt, market-

130 Levitin, supra note 7, at 2068.
131 See Lin, supra note 7, at 590–95 (discussing the limitations of public law in regulating modern finance).
oriented regulation, in some cases, can be more knowledgeable and more responsive to the practices of the rapidly changing marketplace. More market-oriented regulation will likely also have the added benefit of encouraging experimentation and competition in the marketplace. 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. 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.”

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*. 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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139 See Markham, *supra* note 137, at xii–xiv.
markets and the greater economy. The modes of market manipulation are only limited by the imagination and deviousness of humans. 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. 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. 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. Cornering generally occurs when one or more parties acquire the total supply of

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140 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.”).

141 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.”).


143 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.”).

144 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. 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. 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.

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. 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. 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. 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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145 MARKHAM, supra note 137, at 3.
146 Id.
147 Id.
148 See id. at 44, 50–51, 76–90 (discussing the passage and impact of various landmark legislation on market manipulation).
illiquid circumstances when one or more particular parties can acquire a dominant position.151

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.152 Front running is generally considered illegal and a form of securities fraud.153 Securities regulations explicitly prohibit front running large block trades of securities by broker-dealers.154

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.155 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.156

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.157 Wash trading can inflate prices of a

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153 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.”).


155 See HAZEN, supra note 152, at 574.


157 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. 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. 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. Congress and the courts have long frowned upon wash trading as an illegal threat to the proper and fair functions of financial markets.

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. 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. The pump-and-dump scheme has existed for centuries in financial markets,

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159 See MARKHAM, supra note 137, at 7–8.

160 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).

161 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] . . . .”).

162 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. SIST. & 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.”).

163 MARKHAM, supra note 137, at 257.
particularly those involving securities. It has been traced back as far as the “South Sea Bubble” during the 1700s.

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. These aggressive tactics include high pressure cold calling, assuring high returns, and outright lying about the promoted securities. These tactics are well depicted in popular culture through movies like *Boiler Room* and *The Wolf of Wall Street*.

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. 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.

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. The SEC also created the Office of Internet Enforcement to

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164 Id.
165 Id., supra note 152, at 618–19.
battle these attempts at market manipulation. 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.

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. 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.

Financial markets are highly reliant on benchmarks as informational gauges of performance and value. The Dow and the S&P 500 represent the value and performance of the U.S. stock market. The gross domestic product (GDP) summarizes the economic performance of a country. The consumer price index (CPI) indicates the cost of living by estimating the changes in prices of a basket of common goods and services. The London InterBank Offered Rate (LIBOR) measures the interest rates between banks. 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. Similarly, the prices of bonds are influenced directly by LIBOR as it sets the baseline for pricing many bonds.
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. 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. 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.

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 manipulation...

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183 Verstein, supra note 174, at 224–25.
manipulation, cybernetic market manipulation. 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. 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. 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.


187 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).

188 BROWN, supra note 57, at 113.

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.\textsuperscript{190} 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.\textsuperscript{191} 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.\textsuperscript{192} 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.\textsuperscript{193}

Both pinging and spoofing are made possible by the evolution of market operations from a manual enterprise to a computerized enterprise.\textsuperscript{194} The rise of autonomous, high-speed supercomputers running on smart algorithms made both methods of market manipulation possible and profitable since both pinging and spoofing require the rapid submission and cancellation of voluminous orders measured in seconds.\textsuperscript{195} 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


\textsuperscript{191} Massimiliano Marzo, Designing a Trading Market, in MARKET MICROSTRUCTURE IN EMERGING AND DEVELOPED MARKETS 159, 171 (H. Kent Baker & Halil Kiymaz eds., 2013).


\textsuperscript{193} See supra Part I.A.2.


\textsuperscript{195} Id.; PATTERSON, supra note 2, at 62–63, 208–09.
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.

There has been much recent debate and discussion among scholars and regulators about tactics like pinging and spoofing in connection with the rise of high-frequency trading and algorithmic systems in financial markets. Policymakers and regulators have taken many important early steps to better understand and govern new manipulative tactics like pinging and spoofing. 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. The efficacy of these preliminary actions on pinging 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. 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.
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. 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. 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. 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.

In recent years, regulators and policymakers have examined flash orders and electronic front running but have not banned the practice. The SEC proposed a rule in 2009 to eliminate the practice of flash orders, but the rule was never adopted. 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. 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.

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203 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).
204 Lewis, supra note 8, at 45.
209 See Markham, supra note 137, at 323; Teall, supra note 151, at 88.
210 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. 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. 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. 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. 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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213 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.”).

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.215 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.216 In 2014, it was revealed that Russian hackers infiltrated the NASDAQ main computer system that manages its trading data and process.217 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.218 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.219 Avon shares rose over 20% because of the false filing and were temporarily halted from trading.220 Later in 2015, fraudsters created a fake Bloomberg News website to tout a nonexistent takeover of Twitter.221 The fake news report caused Twitter shares to increase by 7% before crashing after the hoax was exposed.222 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.223

216 Chozick & Perlroth, supra note 48.
218 See VENGERIK ET AL., supra note 212, at 3; Perlroth, supra note 3.
219 Goldstein, supra note 3.
220 Id.
222 Id.
223 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. The emergence of cybernetic market manipulation presents policy and regulatory challenges related to resources, detection, and enforcement.

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. 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. Furthermore, private firms also expend significant

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224 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 . . . cau[se]d 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.”).

225 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.”).


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

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.229 In terms of technology, regulators simply lack adequate resources to keep pace with private actors in the new marketplace.230 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.231 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.232 As a result of the technological disparity, regulators are frequently using twentieth-century tools to combat 21st-century misconduct in the marketplace.233 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


229 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.”).


231 See, e.g., supra Part II.B (discussing new technological advances at the SEC).


233 See Patterson, supra note 122.
dollars, while government regulators can only pay a fraction of that sum. 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.

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.

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. As such, significant movements in market prices can last for merely milliseconds. Today, high-frequency trading accounts—for trade volumes and dollar values—measure in the hundreds of billions daily. In recent years, high-frequency trading has accounted for 30% of all foreign-exchange transactions, 35% to 40% of all foreign-exchange transactions, 40% to 40% of all


235 PATTERSON, supra note 2, at 230.

236 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.


European equity trading, and 60% of all U.S. equity trading. 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.

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. 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. 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. 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. 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. Algorithmic computer programs processing deluges of data are behind many financial transactions in...
today’s marketplace. These programs can be designed to analyze mountains of data, identify valuable opportunities, and invest accordingly without any human assistance. 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.

In 2013, it was reported that 90% of the world’s data at that time was generated in the previous two years. It has also been estimated that the overwhelming amount of the world’s information is now stored digitally. 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. 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.

247 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.


250 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.


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. 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. 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. 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. Additionally, more and more market activities are taking place in private electronic venues called “dark pools.” 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. Dark pools are regulated differently than registered exchanges,

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.”).

dela Merced, supra note 253.

Id.


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 ATNs 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/speech102109mds.htm).

and can also facilitate complex financial arrangements in relatively less liquid instruments with relatively less regulation, compared to traditional trading forums. 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.

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. 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. In particular, laws have historically focused on schemes
effectuated by human actors with the ill intent to manipulate the markets and not on schemes that largely utilize autonomous computerized systems. 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.

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. 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. 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.

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.


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)).


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.”).

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).

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 . . . .”)

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.269 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.270

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.271 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-5272 and the CFTC’s newer Rule 180.1273 may ultimately catch up to new market realities.274 In the meantime, regulators can use rules like the Market Access
Rule that require proper supervision to indirectly combat the new schemes of market manipulation while sidestepping the thorny issue of scienter. 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.

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. 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.

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

275 See, e.g., 15 U.S.C. § 78o(b)(4)(E) (2012) (mandating “reasonab[le] 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 Mktls., 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 (“The 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.”).


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. Financial intermediaries truly are a market of intermediaries of various types and sizes. Intermediation is a fact of modern finance. Investment banks, commercial banks, mutual funds, stock exchanges, clearinghouses, brokerages, and other intermediaries form the modern financial infrastructure. 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. 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

278 See Yadav, supra note 262, at 1090–94 (advocating for empowering exchanges to better help regulate financial markets).
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.283 Financial regulators already require reasonable and diligent supervision by financial intermediaries.284 Moreover, in response to new threats and new regulation in the marketplace, many financial firms already invest substantial resources in compliance, technology, and cybersecurity.285 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,286 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.287 Just as the principle of net neutrality seeks to safeguard

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283 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 DUKEL.J. 1267, 1318–19 (2017) (discussing how private intermediaries can serve as important regulators in more digitized marketplace).


287 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. 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. 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.

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

\(^{288}\) See Thel, supra note 270, at 280 (encouraging cautious legal interventions for the complex problems associated with market manipulation).

\(^{289}\) See supra Part III.B.3.


\(^{291}\) See, e.g., PATTERSON, supra note 2, at 8–10.

\(^{292}\) 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.\textsuperscript{293} 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.\textsuperscript{294} To combat these disruptive actions and the new modes of market manipulation, greater emphasis needs to be placed on financial cybersecurity.\textsuperscript{295} 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.\textsuperscript{296} 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.\textsuperscript{297} 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—

\textsuperscript{293} See Vengerik et al., supra note 212, at 3; Nicole Perlroth & 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 Perlroth, 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/china-army-is-seen-as-tied-to-hacking-against-us.html [https://perma.cc/4TLA-6WYG].


\textsuperscript{296} 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”).

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

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.299 While some firms have been making significant investments in cybersecurity, many have not.300 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. 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.302


300 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.”).


The federal government could utilize various policy tools to incentivize private financial firms to improve their cybersecurity in a more proactive manner. 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. 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. 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. 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. 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. 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.

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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307 See Bambauer, supra note 303, at 1062–63.
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. 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. Polling and commentary in recent years have suggested that confidence in the fairness of equity markets among Americans has dropped significantly. Nevertheless, ordinary investors still make up a significant faction of the investor population.

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. 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

312 Fox, Glosten & Rauterberg, supra note 7, at 194.
approach for years.315 Fortunately, in recent years, more and more investors have been moving their money into passive funds.316 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.317 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.318 In reality, ordinary investors can be incredibly unskilled and obtuse when compared to sophisticated investors like high-frequency traders.319 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.320 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


317 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”).

318 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”).


suggest that ordinary investors should not be trying to pick winners and losers in the stock market.\textsuperscript{321} 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\textsuperscript{322}:

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

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

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.\textsuperscript{323} 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


long term. 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. 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. 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. 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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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.