

# PRESERVING CAPITAL MARKETS EFFICIENCY IN THE HIGH-FREQUENCY TRADING ERA

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## *Abstract*

*Although HFT has become an important feature of financial markets internationally, its impact on the functioning of equity markets is still under discussion, as HFT can negatively affect market quality and stability. Regulatory measures recently adopted on both sides of the Atlantic to better control HFT-related risks chiefly focus on the stability, orderly functioning and integrity of markets, but give insufficient consideration to how HFT interacts with the allocative function of price discovery. In order to fill this gap, this article focuses on how HFT-related informational inequalities among investors threaten equity markets' (long-term) efficiency. Subscription to newswires and market data-feeds, along with co-location, grant HFTs early access to market-moving information that allows for latency arbitrage and trading ahead of other investors, which can discourage informed (slower) traders from carrying out costly fundamental analysis. Therefore, HFT challenges the theoretical framework underlying the Efficient Capital Markets Hypothesis, and can negatively affect price accuracy, real resource allocation and equity markets' allocative efficiency. Against this backdrop, this Article develops an analytical framework for possible regulatory strategies that seek to limit the negative effects of HFT on allocative market efficiency by reducing HFTs' speed advantage or by incentivizing fundamental informed traders to enter markets where they face costly pressures to compete with HFTs. Restricting the sale of trade data feeds or mandating speed bumps may discourage HFT and weaken its positive effects in terms of increased liquidity and better short-term price discovery, without however definitively curbing HFT-related risks concerning long-term price accuracy, while the replacement of the current continuous trading regime with a batched auctions-based regime would require major regulatory changes. The introduction of a continuous, event-driven, and faster issuer disclosure regime could limit these possible drawbacks by providing*

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*informed traders with more frequent and cheaper access to relevant information.*

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#### I. INTRODUCTION

One of the most striking evolutionary trends that financial markets have been experiencing internationally, especially over the past 20 years, is the rise of high-frequency trading (HFT), which is a specific type of algorithmic

trading.<sup>1</sup> HFT has been fueled over time by both technological innovation, which has made market and proprietary infrastructures available supporting its characteristic workability and operational features, and regulatory issues.<sup>2</sup> Specifically, technological innovation has caused market structures to rapidly evolve into predominantly automated trading systems, and supports trading functions that are continuously improved in terms of increased speed, capacity and sophistication, along with reduced latency.<sup>3</sup>

On the regulatory side, increased competition between trading venues, the impressive growth of alternative trading systems (ATSs),<sup>4</sup> including dark pools, and subsequent trading fragmentation across venues, along with pricing decimalization, were driven in the U.S. by the 1975 “National Market System” amendments to the Exchange Act (Sec. 11A), along with the adoption of a number of implementation measures by the U.S. Securities and Exchange Commission (SEC), including most notably the 1996 Order Handling Rules,<sup>5</sup> Regulation National Market System (Reg NMS) in 2005<sup>6</sup> and Regulation Alternative Trading Systems (Reg ATS) in 2008.<sup>7</sup>

Similarly, on the other side of the Atlantic, the removal, by means of MiFID I,<sup>8</sup> of the possibility for European Union (EU) Member States to require that equities must be traded on regulated markets only (the so-called concentration rule) has allowed for multilateral trading facilities alternative to regulated markets to develop in Europe, fostered competition among venues, and supported trading fragmentation, although not with equal intensity in all European countries, and in a way that is by far not as significant as in the U.S. after the adoption of Reg NMS.<sup>9</sup>

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1. See MICHAEL LEWIS, *FLASHBOYS: A WALL STREET REVOLT* (2015) (presenting a colorful—and popular—account of HFT).

2. See Tom C.W. Lin, *The New Investor*, 60 *UCLA L. REV.* 678, 687–89 (2013) [hereinafter Lin I] (discussing the role of technology innovation in fueling HFT and regulatory issues that follow).

3. *Id.* at 687–89, 727.

4. See Concept Release on Equity Market Structure, Exchange Act Release No. 61,358, 75 Fed. Reg. 3594, 3598 (Jan. 21, 2010) [hereinafter SEC Concept Release] (showing that, as of 2009, registered exchanges and electronic communication networks (ECNs) collectively executed approximately 74.6% of share volume, while undisplayed trading centers—dark pools and broker-dealer internalization—executed the remaining 25.4%).

5. Order Execution Obligations, Exchange Act Release No. 37,619A, 61 Fed. Reg. 48,290 (Sept. 12, 1996).

6. Regulation National Market System, Exchange Act Release No. 51,808, 70 Fed. Reg. 37,496 (June 29, 2005) [hereinafter NMS Adopting Release].

7. Regulation of Exchanges and Alternative Trading Systems, Exchange Act Release No. 40,760, 63 Fed. Reg. 70,844 (Dec. 22, 1998).

8. Directive 2004/39/EC, of the European Parliament and of the Council of 21 April 2004 on Markets in Financial Instruments Amending Council Directives 85/611/EEC and 93/6/EEC and Directive 2000/12/EC of the European Parliament and of the Council and Repealing Council Directive 93/22/EEC, 2004 O. J. (L 145) 1.

9. See EUR. SEC. MKTS. AUTH., ORDER DUPLICATION AND LIQUIDITY MEASUREMENT IN EU EQUITY MARKETS 8 (2016) [hereinafter ESMA ORDER DUPLICATION], [https://www.esma.europa.eu/sites/default/files/library/2016-907\\_economic\\_report\\_on\\_duplicated\\_orders.pdf](https://www.esma.europa.eu/sites/default/files/library/2016-907_economic_report_on_duplicated_orders.pdf) (noting that the share of trading on multilateral trading facilities (MTFs) was close to zero at the beginning of 2008, while it was reported to be equal to 18% of total turnover at the start of 2011, and had reached 28% of trading in electronic order books and 22% of total equity trading in 2013).

Consequently, the rise of HFT and its significant impact in terms of trading volumes are common features of the U.S. and European financial markets.<sup>10</sup> At present, HFT is reported to account for roughly 55% of trading volume in U.S. equity markets,<sup>11</sup> and between 23% and 43% of value traded, or 58% and 76% of orders, in European equity markets.<sup>12</sup>

A significant proportion of trading in equities is therefore originated by highly sophisticated computing systems that allow for the automated algorithmic initiation, update, cancellation, routing and execution of thousands of orders per second with no human intervention.<sup>13</sup> It is widely acknowledged that electronic and algorithmic trading technology as a whole, and high frequency traders (HFTs) as forefront technology users, have provided benefits to the market and market participants in general, in that they have fostered wider participation in markets, increased liquidity, narrowed spreads, reduced short-term volatility and provided a means for clients to obtain better execution of orders.<sup>14</sup> However, as we shall discuss below, these benefits have come at a price in terms of a number of risks that other market participants are faced with.<sup>15</sup> Over time, HFT has brought to light a number of regulatory issues that would hardly have been conceivable before it developed, *inter alia* challenging the effectiveness of equity markets' informational efficiency.<sup>16</sup>

Against this backdrop, this Article specifically focuses on how HFT-related informational inequalities can threaten equity markets' (long-term) efficiency, based on the premises that the current regulatory framework actually tolerates two-tiered access to information, which allows HFTs to systematically anticipate other market participants' orders.<sup>17</sup> More precisely, subscription to news wires and market data-feed services, along with co-location, grant HFTs a time advantage in accessing market-moving information that allows for latency

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10. See, e.g., RENA S. MILLER & GARY SHORTER, CONG. RESEARCH SERV., HIGH FREQUENCY TRADING: OVERVIEW OF RECENT DEVELOPMENTS 1 (Apr. 4, 2016), <https://fas.org/sgp/crs/misc/R44443.pdf> (discussing HFT's impact on trading volumes in U.S. markets); see also Björn Hagströmer & Lars Nordén, *The Diversity of High-Frequency Traders*, 16 J. FIN. MKTS. 741, 741–42 (2013) (discussing HFT's impact on trading volumes in European markets).

11. MILLER & SHORTER, *supra* note 10, at 1.

12. EUR. SEC. MKTS. AUTH., HIGH-FREQUENCY TRADING ACTIVITY IN EU EQUITY MARKETS (2014) [hereinafter ESMA HIGH-FREQUENCY TRADING] [https://www.esma.europa.eu/sites/default/files/library/2015/11/esma20141-hft\\_activity\\_in\\_eu\\_equity\\_markets.pdf](https://www.esma.europa.eu/sites/default/files/library/2015/11/esma20141-hft_activity_in_eu_equity_markets.pdf) (noting that data referred to estimations for HFT activity are approximate, due to uncertainties regarding the operational definition of HFT and the variety of approaches used to estimate HFT activity); see also Hagströmer & Nordén, *supra* note 10, at 742 (discussing the various methodology of these calculations).

13. Lin I, *supra* note 2, at 689–92.

14. See Mary Jo White, Chair, Sec. & Exch. Comm'n, Address at the Sandler O'Neil & Partners, L.P. Global Exchange and Brokerage Conference: Enhancing Our Equity Market Structure (June 5, 2014) [hereinafter White I], <http://www.sec.gov/news/speech/2014-spch060514mjw> (considering the benefits of HFT); see also Directive 2014/65/EU, of the European Parliament and of the Council of 15 May 2014 on Markets in Financial Instruments and Amending Directive 2002/92/EC and Directive 2011/61/EU, 2014 O.J. (L 173) 349, 359 [hereinafter MiFID II] (discussing some market benefits of HFT).

15. See, e.g., SEC Concept Release, *supra* note 4, at 3611 (discussing some risks to markets posed by HTF technology).

16. See Yesha Yadav, *How Algorithmic Trading Undermines Efficiency in Capital Markets*, 68 VAND. L. REV. 1607 (2015) [hereinafter Yadav I] (highlighting some challenges to efficiency posed by algorithmic trading).

17. Steven R. McNamara, *The Law and Ethics of High-Frequency Trading*, 17 MINN. J.L. SCI. & TECH. 71, 108 (2016).

arbitrage and anticipation of informed traders' orders.<sup>18</sup> While helping price discovery in the very near term, latency arbitrage by HFTs increases transaction costs of non-HFTs and can disincentivize a fundamental analysis on the side of slower traders, which in the longer run may negatively affect price informativeness and real resource allocation, thereby weakening equity markets' allocative efficiency.<sup>19</sup>

As they are chiefly focused on financial market stability and integrity, the initiatives recently taken by the SEC, and the specific measures adopted at the European level, do not appear to consider how HFT interacts with the allocative function of price discovery, the protection of which is generally regarded as one of the building blocks for financial markets regulation.<sup>20</sup>

As we explain in this Article, regulatory measures intended to reduce the speed advantage of HFTs and to level out HFT-based informational inequalities cannot on their own preserve allocative market efficiency. In order to incentivize fundamental informed traders to enter markets where they face costly pressures to compete with HFTs and to continue to play their essential role in enhancing market price informativeness, the introduction of a continuous, event-driven and faster disclosure regime for issuers would provide informed traders with more frequent and cheaper access to relevant information.<sup>21</sup> It is therefore conceivable that further regulatory intervention may consider measures aimed at promoting allocative efficiency within HFT dominated capital markets by subsidizing fundamental informed trading through facilitated access to material issuer information.

Our analysis proceeds as follows: Part II defines HFT and, based upon the diverging opinions and ambiguous findings from empirical evidence, provides an overview of how it impacts upon different measures of equity market efficiency. Emphasis is given to a growing body of scholarship finding that HFT can negatively affect price discovery in the longer run. Part III outlines the regulatory framework applicable to algorithmic trading and HFT in the U.S. and in Europe, noting that the fundamental approach followed in dealing with critical HFT-related issues basically converges. Part IV focuses specifically on informational inequalities related to HFT and discusses how these may negatively impact the long-term efficiency of equity markets by affecting price accuracy and its allocative function. Part IV also suggests why the existing regulatory framework fails to adequately prevent HFT-related informational inequalities. Part V develops an analytical framework that seeks to limit the negative effects of HFT on long-term market efficiency and considers different solutions that may be taken into consideration for further regulatory intervention. Finally, Part VI sets out the concluding remarks.

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18. SEC Concept Release, *supra* note 4, at 3610–11.

19. See generally Yadav I, *supra* note 16 (discussing the relationships between HFT, informational efficiency and allocative efficiency).

20. *Id.* at 1642–43, 1670.

21. *Id.* at 1665–66.

## II. HFT'S MARKET EFFECTS

This Part will provide a definition of HFT and an overview of the large body of research concerning the risks and benefits associated with HFT. In particular, in order to lay the conceptual groundwork for the following analysis, this Part will offer a general outlook of literature focusing on how HFT influences market functioning.

### A. *Defining HFT*

HFT is not a trading strategy in itself, but a technique characterized by the use of technology advanced to implement rather traditional strategies, which, as outlined by the Securities and Exchange Commission (SEC), may be passive or aggressive, such as market making, arbitrage, structural or directional strategies.<sup>22</sup> Even though HFT is also characterized by the lack of human intervention in making and executing orders, it differs from the broader category of algorithmic trading essentially in terms of the volume, speed and extremely low latency,<sup>23</sup> which are typically facilitated by the co-location of HFT facilities in close physical proximity to a trading venue's matching engine.<sup>24</sup> Along with subscription to news wires and trade data-feed services, which directly deliver real-time information concerning news, prices, orders and trades, and communication between HFTs' own inter-connected facilities at the various exchanges, co-location and technology advance allow HFTs to early gain knowledge of new information, and transactions occurring on the venues, and to react to information instantly before it reaches other investors.<sup>25</sup> Combined with trading fees which are kept low by competition between venues for order flow, and the favorable pricing models adopted in order to attract liquidity providers (e.g. liquidity rebates granted for non-marketable orders, according to the so-called "make/take" fee structure),<sup>26</sup> these features enable algorithms to instantly submit cross-market orders, update or cancel orders previously posted, and take advantage of the slightest profit-maximizing opportunities.<sup>27</sup>

HFTs mainly deal on their own account on a proprietary basis, and tend to trade securities with a high market value, due to their enhanced liquidity.<sup>28</sup> This is because positions are typically liquidated within a short time frame, so as to close the trading day at, or close to, a flat position.<sup>29</sup> The daily performance of an extremely high number of trades with a rapid turnover of securities is

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22. See generally SEC Concept Release, *supra* note 4, at 3606–10 (providing a descriptive definition of HFTs).

23. Lin I, *supra* note 2, at 691–92.

24. See, e.g., ESMA HIGH-FREQUENCY TRADING, *supra* note 12, at 14 (finding that 80% of HFT firms use co-location at one trading venue at least).

25. Michael J. McGowan, *The Rise of Computerized High Frequency Trading: Use and Controversy*, 2010 DUKE L. & TECH. REV. 16, ¶ 20 (2010).

26. More in general, exchanges have a significant incentive to structure trading in a way that attracts high-frequency traders, that are their largest customers.

27. McGowan, *supra* note 25, ¶¶ 20–23.

28. See ESMA HIGH-FREQUENCY TRADING, *supra* note 12, at 15 (analyzing HFT activity and underlying stock features in relation to stocks with a high market value).

29. *Id.* at 6.

essential in order to exploit the least perceptible bid-ask spreads, engage in cross-market arbitrage, or predict future price movements, thereby earning small profits on each individual transaction (although still considerable in absolute terms with respect to the total volume of trade), while deploying little capital at risk compared to non-HFTs.<sup>30</sup>

These features recur in practice, and also within the relevant regulatory context, both in the U.S. and European settings, although with one noteworthy difference.<sup>31</sup>

The SEC refers to HFT in descriptive, broad terms only, and has refrained so far from providing a precise definition or introducing specific measures, while focusing on strategies that raise concern.<sup>32</sup> On the other hand, European lawmakers—following the lead set by the German Act on the Prevention of Risks and Abuse in High-frequency Trading of May 7, 2013<sup>33</sup>—chose to trace a different path when adopting Directive 2014/65/EU of May 15, 2014 on markets in financial instruments (MiFID II),<sup>34</sup> which includes specific provisions on algorithmic trading and HFT. Article 4(1)(40) MiFID II defines HFT with reference to the simultaneous presence of three crucial elements, explicitly referring to a “high-frequency algorithmic trading technique” in terms of,

[A]n algorithmic trading technique characterised by: (a) infrastructure intended to minimise network and other types of latencies, including at least one of the following facilities for algorithmic order entry: collocation, proximity hosting or high-speed direct electronic access; (b) system-determination of order initiation, generation, routing or execution without human intervention for individual trades or orders; and (c) high message intraday rates which constitute orders, quotes or cancellations[.]<sup>35</sup>

On the other hand, according to Article 4(1)(39), “algorithmic trading” is defined as:

[T]rading in financial instruments where a computer algorithm automatically determines individual parameters of orders such as whether to initiate the order, the timing, price or quantity of the order or how to manage the order after its submission, with limited or no human intervention, and does not include any system that is only used for the purpose of routing orders to one or more trading venues or for the processing of orders involving no determination of any trading

30. McGowan, *supra* note 25, ¶¶ 22–29; *see* Yadav I, *supra* note 16, at 1622 (explaining how HFT uses pre-set algorithms in order to achieve its outcomes).

31. *See, e.g.*, SEC Concept Release, *supra* note 4 (discussing the specific market structure performance analysis as related to HFTs).

32. *Id.* at 3606–07.

33. Gesetz zur Vermeidung von Gefahren und Missbräuchen im Hochfrequenzhandel [Hochfrequenzhandelsgesetz] [High-Frequency Trading Act], May 14, 2013, BUNDESANZEIGER, at 1162, 2013 (Ger.).

34. *See* MiFID II, *supra* note 14 (providing provisions dealing with algorithmic trading and HFT).

35. The notion of “high message intraday rate” in accordance with Article 4 (1) (40) MiFID II is defined by Article 19 of the Commission Delegated Regulation (EU) 2017/565 of 25 April 2016 supplementing Directive 2014/65/EU of the European Parliament and of the Council as regards organizational requirements and operating conditions for investment firms and defined terms for the purposes of that Directive O. J. (L 87).

parameters or for the confirmation of orders or the post-trade processing of executed transactions<sup>36</sup>

*B. How HFT Impacts Equity Markets: A Literature Survey*

As is well known, HFT specifically captured the attention of market participants, supervisory authorities and regulators, as well as academics and public opinion broadly, following the NYSE “Flash Crash” of May 6, 2010, when within less than thirty minutes the Dow Jones Industrial Average first lost 9 percent of its value, and then recovered almost its entire loss.<sup>37</sup>

In spite of its initial association with HFT, subsequent joint investigations by the SEC and the U.S. Commodity Futures Trading Commission (CFTC) reached the conclusion, which was also supported by a number of scholars, that HFTs accelerated and exacerbated its effects in terms of reduced market liquidity and volatility, but did not however directly cause the Crash.<sup>38</sup> Seemingly, the Crash originated from a combination of circumstances and was triggered by a large, automated sell order, which drove market makers and other liquidity providers such as HFTs to temporarily exit the market, possibly due to the risk perceived by them of being adversely selected by an informed aggressive trader, all of which resulted in a temporary liquidity collapse.<sup>39</sup> Data feed anomalies from the Consolidated Tape System, which trading halts alone were not sufficient to counterbalance, and which caused uncertainty among algorithmic traders and their withdrawal from the market, also counted among the contributing causes of the Crash.<sup>40</sup>

Despite the absence of a direct causal link between HFT and the Flash Crash, however, HFT is widely regarded by lawmakers, regulators and scholars as potentially affecting the orderly functioning and overall quality of financial markets in terms of their stability, volatility, liquidity and informational

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36. MiFID II, *supra* note 14.

37. The Flash Crash was not an isolated event: further events recurred in the U.S. treasury markets on October 15, 2014, the European and U.S. stock futures markets on August 24, 2015, the NYSE on July 9, 2015, and in other markets as well. See generally Albert J. Menkveld & Bart Z. Yueshen, *The Flash Crash: A Cautionary Tale about Highly Fragmented Markets*, MGMT. SCI. (forthcoming), <https://ssrn.com/abstract=2243520> (considering the causes and impacts of the Flash Crash).

38. See U.S. COMMODITY FUTURES & TRADING COMM’N & U.S. SEC. & EXCH. COMM’N, FINDINGS REGARDING THE MARKET EVENTS OF MAY 6, 2010: REPORT OF THE STAFFS OF THE CFTC AND SEC TO THE JOINT ADVISORY COMMITTEE ON EMERGING REGULATORY ISSUES (Sept. 30, 2010), <https://www.sec.gov/news/studies/2010/marketevents-report.pdf> (reporting the CFTC and SEC’s findings as to causes of the Crash); Andrei A. Kirilenko et al., *The Flash Crash: High-Frequency Trading in an Electronic Market*, 72 J. FIN. 967, 971 (2017) (finding that the trading pattern of HFTs did not change when prices fell during the Crash); see also Henry T.C. Hu, *Too Complex to Depict? Innovation, “Pure Information,” and the SEC Disclosure Paradigm*, 90 TEX. L. REV. 1601, 1703–04 (2012) (analyzing the events before the Crash); Frank Partnoy, *Don’t Blink: Snap Decisions and Securities Regulation*, 77 BROOK. L. REV. 151, 168–72 (2011) (finding that HFTs did not trigger the Crash).

39. See Merritt B. Fox, *MiFID II and Equity Trading: A US View, in REGULATION OF THE EU FINANCIAL MARKETS: MiFID II AND MiFIR 511–12* (Danny Busch & Guido Ferrarini eds., 2017) [hereinafter Fox I] (discussing contributing causes and the trigger to the Crash).

40. See Eric M. Aldrich, Joseph A. Grundfest, & Gregory Laughlin, *The Flash Crash: A New Deconstruction 50–51* (Mar. 26, 2017) (unpublished manuscript), <https://ssrn.com/abstract=2721922> (establishing theories on the contributing causes of the Flash Crash).

efficiency.<sup>41</sup> HFT may also impact market integrity as it can favor market manipulation practices that are not easy to detect, and even less easy to prove and prosecute, as well as insider trading according to schemes that the current market abuse and mandatory disclosure regimes may not always adequately address.<sup>42</sup>

Therefore, although the actual reach and impact of these risks remain partially unclear, since the conclusions provided by studies concerning the risks and benefits of HFT are mixed, before commenting on the relevant regulatory framework for HFT, an overview of studies and empirical evidence focusing on how the strengths and weaknesses of HFT impact financial markets and participants is needed.

### 1. *Liquidity and Volatility*

According to the prevailing opinion, one of the benefits associated with HFT is that, since they only earn if they continuously trade massive volumes, HFTs act as economic market makers, providing markets with liquidity and offering crucial advantages in terms of the certainty of finding matching orders to investors who are willing to trade.<sup>43</sup> In fact, by employing electronic market making trading strategies, HFTs have increasingly taken on the role once played by (regulated) specialists and designated market makers.<sup>44</sup>

Unlike regulated market makers however, HFTs (unless they deal on their clients' account) are ordinary traders, and are not subject either to the restrictions imposed in order to counter increased risks of insider trading or to a positive obligation to continue to provide liquidity in bad times and to smooth order imbalances.<sup>45</sup> Since HFTs provide liquidity "simply as a by-product of their attempt to earn trading profits,"<sup>46</sup> the question is whether they provide valuable liquidity, or—as noted by the SEC—"phantom liquidity that disappears when most needed by long term investors and other market participants[.]"<sup>47</sup>

Available empirical evidence indicates that HFT actually intensifies during market phases where institutional investors face large trade imbalances, which is consistent with the liquidity provision role played by HFTs.<sup>48</sup> However, as virtually all positions are closed at the end of the trading day, Lin Tong notes

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41. See, e.g., Frank Zhang, *High-Frequency Trading, Stock Volatility, and Price Discovery* 2–3 (Dec. 2010) (unpublished manuscript), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1691679](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1691679) (demonstrating the correlation between HFT and volatility).

42. Matt Prewitt, *High-Frequency Trading: Should Regulators Do More?*, 19 MICH. TELECOMM. & TECH. L. REV. 131, 147–48 (2012).

43. See generally Yesha Yadav, *The Failure of Liability in Modern Markets*, 102 VA. L. REV. 1031, 1066 (2016) [hereinafter Yadav II] (discussing HFT's role as a market maker).

44. Robert A. Korajczyk & Dermot Murphy, *High Frequency Market Making to Large Institutional Trades*, REV. FIN. STUD. (forthcoming manuscript at 34–35), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2567016](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2567016).

45. Paul G. Mahoney & Gabriel Rauterberg, *The Regulation of Trading Markets: A Survey and Evaluation* 39 (Va. Law & Econ. Research Paper Series No. 2017-07, 2017), <https://ssrn.com/abstract=2955112>.

46. *Id.* at 4.

47. SEC Concept Release, *supra* note 4, at 3608.

48. Lin Tong, *A Blessing or a Curse? The Impact of High Frequency Trading on Institutional Investors* 24–25 (Eur. Fin. Ass'n Annual Meetings 2014 Paper Series, 2015), <https://ssrn.com/abstract=2330053>.

that “such liquidity provision is short-lived, i.e., within a day. Therefore, a more accurate description of the liquidity provision role of HF traders is that they serve as intraday intermediaries and quickly pass the imbalances from institutions to other market participants.”<sup>49</sup> Considering that most trading (especially, large orders by passive institutional investors) takes place just before the closing of the exchanges, the beneficial intra-day liquidity effect from HFT may arguably not affect institutional investors as much as inter-day provision of liquidity would.<sup>50</sup>

Moreover, other studies highlight that HFT is not limited to primarily passive market making strategies and also includes aggressive, liquidity-taking strategies, such as order anticipation, which has been found to be popular among HFTs.<sup>51</sup> Evidence as to how HFTs’ market making interacts with large institutional orders suggests that, while passive HFT reduces spreads and intraday volatility, HFT order anticipation increases adverse selection costs for institutional market participants, along with volatility.<sup>52</sup> Consequently, liquidity provision by HFTs is deemed to come with extra costs to institutional investors in terms of higher execution costs for large and information-based orders.<sup>53</sup>

Furthermore, according to the European Securities and Markets Authority (ESMA), the higher proportion of both “duplicated” HFT orders (i.e. similar orders posted on multiple venues at the same time, as a means of ensuring execution in fragmented markets) and cancellation orders for unmatched duplicated orders suggest—as compared with non-HFTs—that HFTs contribute more than non-HFTs to determining an overestimation of the overall liquidity actually available on the marketplace.<sup>54</sup> What is more, Olga Klein and Shiyun Song from the University of Warwick find that cross-market HFT induces stronger network-wide liquidity co-movements, which emphasize cross-market propagation of liquidity shocks and render equity markets more vulnerable, especially during crisis periods.<sup>55</sup>

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49. *Id.* at 25–26.

50. *Id.* at 5–6.

51. *Id.* at 28; see also STAFF OF THE DIV. OF TRADING & MKTS. U.S. SEC. & EXCH. COMM’N, EQUITY MARKET STRUCTURE LITERATURE REVIEW PART II: HIGH FREQUENCY TRADING 9 (2014) [hereinafter SEC LITERATURE REVIEW], [https://www.sec.gov/marketstructure/research/hft\\_lit\\_review\\_march\\_2014.pdf](https://www.sec.gov/marketstructure/research/hft_lit_review_march_2014.pdf) (recalling empirical studies showing that, based on NASDAQ datasets, liquidity taking orders account for more than 50% of HFT activity).

52. Korajczyk & Murphy, *supra* note 44, at 28–29 (finding that a 10% point reduction in HFT liquidity provision to large stressful trades results in an implementation shortfall increase of 2.5 basis points; overall, implementation shortfall is 11 (35) basis points for non-stressful (stressful) trades and significantly negatively related to HFT liquidity provision); see also SEC LITERATURE REVIEW, *supra* note 51, at 9–10 (for further discussion).

53. See Korajczyk & Murphy, *supra* note 44, at 10 (arguing that HFTs “can worsen the transaction costs of institutional investors and contribute to extreme volatility events.”).

54. See ESMA ORDER DUPLICATION, *supra* note 9, at 24 (finding that (i) 20% of the orders in the sample (100 stocks on 12 trading venues in nine EU countries for May 2013) are duplicated orders, and in 24% of trades the trader immediately cancels unmatched duplicated orders; (ii) duplicated orders are more prevalent for HFTs (34% of orders) than for non-HFTs (12% of orders), accounting for 22% of orders in large cap stocks compared to 12% of orders in small cap stocks; (iii) fragmentation of trading is positively correlated with order duplication; and (iv) the proportion of cancelled orders is higher for HFTs (28%), large cap stocks (27%) and where trading is more fragmented (31%)).

55. Olga Klein & Shiyun Song, Multimarket High-Frequency Trading and Commonality in Liquidity 3, 27 (July 22, 2017) (unpublished manuscript), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2984887](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2984887).

At the same time, it has also been noted that the risks associated with events such as the Flash Crash should not be underestimated by emphasizing their temporary nature.<sup>56</sup> Although on the specific occasion of May 2010 the losses suffered by the Dow Jones were rapidly recovered, it is not predictable that prices will always return to normal quickly. If flash events were to become more frequent, as is likely to be the case,<sup>57</sup> and no adequate countermeasures were taken to strengthen stability, markets would probably become less reliable.<sup>58</sup>

Moreover, further studies show that the increasing reliance on technology combined with HFTs' significant trading volume can, in some instances, amplify price discovery shortfalls associated with informed traders' cognitive biases or, especially under uncertain market conditions, determine price over-reactions to public disclosures (concerning issuers or the market generally), exacerbate volatility, and cause marketplaces to function in a disorderly manner.<sup>59</sup> Additional empirical evidence seems to support the view that HFT increases volatility on equity markets, while other studies have found the evidence to be mixed.<sup>60</sup>

As was shown by the well-known Knight Capital case in 2012, unpredictable errors and inaccuracies in the algorithms employed can lead to deceptive orders, which are inconsistent with the criteria originally set by the traders themselves.<sup>61</sup> In 2013, Knight Capital Americas LLC agreed to pay \$12 million as settlement for allegations that it violated the SEC's market access rule, adopted in 2010 as Rule 15c3-5 under Sec.15(c)(3) of the Exchange Act, in relation to a trading incident involving the firm on August 1, 2012 when, due to a defective trading algorithm, it suffered severe losses.<sup>62</sup> An investigation by the SEC found that the firm did not have adequate safeguards in place to limit the risks posed by its access to the markets, and had failed to prevent the entry of millions of erroneous orders.<sup>63</sup> The firm had also failed to conduct adequate reviews of the effectiveness of its controls.<sup>64</sup> The millions of erroneous executions influenced share prices over a period of forty-five minutes on the NYSE, and these share price movements affected other market participants, with

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56. See Tom C.W. Lin, *Compliance, Technology, and Modern Finance*, 11 BROOK. J. CORP. FIN. & COM. L. 159, 171 (2016) (discussing the impact of events such as the Flash Crash).

57. See *id.* (stating that with rising speeds and technology within the financial system, events like the Flash Crash are more likely to occur).

58. See Yadav II, *supra* note 43, 1049–50 (arguing that frequent flash crashes could lead to investor reluctance in trading using algorithmic forums).

59. See Zhang, *supra* note 41, at 2–3 (demonstrating the correlation between HFT and volatility); Ekkehart Boehmer et al., *Algorithmic Trading and Market Quality: International Evidence 2* (AFA 2013 San Diego Meetings Paper, 2018), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2022034](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2022034) (discussing the implications of HFT's significant trading volume); see also MiFID II, *supra* note 14, at 359 (noting how algorithmic trading systems can overreact to market forces and exacerbate volatility).

60. See generally SEC LITERATURE REVIEW, *supra* note 51, at 23–28 (citing studies that have found varying results on HFT and market volatility).

61. Knight Capital Americas LLC, Exchange Act Release No. 70694, 107 SEC Docket 2303, at 2 (Oct. 16, 2013).

62. *Id.* at 18.

63. *Id.* at 12.

64. *Id.* at 3–4.

some participants receiving less favorable prices than they would have done absent these executions, with others receiving more favorable prices.<sup>65</sup>

As Yesha Yadav notes, such events can negatively impact the orderly functioning of the markets as human intervention may not be able to break the circuit in time and prevent the posting or execution of massive erroneous orders, which are capable of driving prices either upwards or downwards within a very short space of time.<sup>66</sup> Due to automated cross-market trading, harm caused by orders originated by defective algorithms can rapidly spread across venues and trigger a “contagion” effect of individual failures.<sup>67</sup> This effect is heightened by the fact that the algorithms used by most HFTs are generally quite similar, and tend to react in the same way to new information.<sup>68</sup> More generally, it has been noted that, since automation relies on predictive programming, which almost by definition entails errors in capturing “messy real world behavior” algorithms introduce a systemic degree of model risk into financial markets.<sup>69</sup> Furthermore, as algorithms are modeled to exit the market where unexpected situations falling outside the scope of their programming arise, the risks associated with market disruption are passed on to other investors.<sup>70</sup> Therefore, although human trading too presents herd behavior and fallacy, HFT, through automation and speed at submitting a very large number of orders, can trigger a superior contagion effect.<sup>71</sup>

## 2. Price Accuracy

The evidence concerning the impact of HFT on price accuracy is also controversial.<sup>72</sup> A number of studies have found no significant evidence that HFT negatively affects price efficiency.<sup>73</sup> On the contrary, other scholars suggest that HFT boosts the process by which information is incorporated into prices, benefiting investors as a whole including retail investors who, according to the Efficient Capital Markets Hypothesis (ECMH), take advantage of the price accuracy determined by informed traders.<sup>74</sup> Moreover, since (in order to earn

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65. *Id.* at 6.

66. Yadav I, *supra* note 16, at 1651–52.

67. See Yadav II, *supra* note 43, at 1037–38 (describing the mechanics of the “contagion” effect).

68. See *id.* at 1037–38 (discussing the “serious harms” that may result from HFTs using similar programming). In relation to the European context, see INT’L ORG. OF SEC. COMM’NS, REGULATORY ISSUES RAISED BY THE IMPACT OF TECHNOLOGICAL CHANGES ON MARKET INTEGRITY AND EFFICIENCY 12–13 (July 11, 2011), <http://www.iosco.org/library/pubdocs/pdf/IOSCOPD354.pdf>; Klein & Song, *supra* note 55, at 4 (finding that multimarket HFT activity induces stronger liquidity co-movements across European markets; therefore, stronger co-variations in aggregate European liquidity facilitate the propagation of liquidity shocks across markets, increasing the risk of contagion and threatening the stability of global financial markets).

69. Yadav I, *supra* note 16, at 1612.

70. *Id.* at 1613–14, 1656.

71. See Yadav II, *supra* note 43, at 1037–38 (discussing the contagion effect associated with HFT).

72. See SEC LITERATURE REVIEW, *supra* note 51, at 10 (noting that a number of studies have produced different findings regarding the relationship between HFT and price accuracy).

73. See *id.* at 24–26 (discussing studies on HFT’s effect on price efficiency).

74. See Ryan Riordan & Andreas Storkenmaier, *Latency, Liquidity and Price Discovery*, 15 J. FIN. MKTS. 416, 418–19 (2012) (discussing how HFT benefits investors); Terrence Hendershott & Pamela C. Moulton, *Automation, Speed, and Stock Market Quality: The NYSE’s Hybrid*, 14 J. FIN. MKTS. 568, 601 (2011) (discussing the enhancement of price discovery due to information being incorporated into prices); Joel Hasbrouck & Gideon Saar, *Low-Latency Trading*, 16 J. FIN. MKTS. 646, 647–48 (2013) (examining the benefits from the increased

profits by buying slightly below value and selling slightly above value) HFTs continuously update their orders in response to transactions occurring on the markets on which they trade, their consistent trading volume will cause prices to converge quickly towards the estimated values of informed traders.<sup>75</sup> Specifically, over the very short term, typically at intra-day or day-to-day levels, HFT is considered to speed up the process by which market prices adjust until they come to reflect the information available to informed traders, and contribute to achieving better price efficiency not only in the individual market but also across exchanges overall, as prices across the system tend to synchronize rapidly due to a consolidated tape and/or to arbitrage.<sup>76</sup>

However, further studies that extend the analysis to longer time frames and maintain a distinction between the two aspects within the process of price discovery of information acquisition and its incorporation into asset prices seem to support on an empirical basis the theoretical view of the Nobel Laureate Joseph Stiglitz, according to whom

[I]f sophisticated market players can devise algorithms that extract information from the patterns of trades, it can be profitable. But their profits come at the expense of someone else. And among those at whose expense it may come can be those who have spent resources to obtain information about the *real economy*. These market players can be thought of as stealing the information rents that otherwise would have gone to those who had invested in information. But if the returns to investing in information are reduced, the market will become less informative. Better “nanosecond” price discovery comes at the expense of a market in which prices reflect less well the underlying fundamentals. As a result, resources will not be allocated as efficiently as they otherwise would be.<sup>77</sup>

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pace of information gathering); Jonathan Brogaard, Terrence Hendershott, and Ryan Riordan, *High-Frequency Trading and Price Discovery*, 27 REV. FIN. STUD. 2267, 2303 (2014) (finding that “HFTs increase the efficiency of prices by trading in the direction of permanent price changes and in the opposite direction of transitory pricing errors”); Viktor Manahov et al., *Does High Frequency Trading Affect Technical Analysis and Market Efficiency? And if so, how?*, 28 J. INTL. FIN. MKTS. INST. & MONEY 131, 153 (2014) (discussing the positive role that HFT plays in price discovery); Matthias Bank & Ralf H. Baumann, *Price Formation, Market Quality and the Effects of Reduced Latency in the Very Short Run*, 37 RESEARCH IN INT’L BUS. & FIN 629, 630 (2016) (setting forth the benefits of HFT’s reduced latency); Evangelos Benos & Satchit Sagade, *Price Discovery and the Cross-Section of High-Frequency Trading*, 30 J. FIN. MKTS. 54, 56 (2016) (discussing findings on HFT’s information contribution); Thierry Foucault et al., *News Trading and Speed*, 71 J. FIN. 335, 340 (discussing the effects of news informational advantage of HFT) (2016); S. Sarah Zhang, *Need for Speed: An Empirical Analysis of Hard and Soft Information in a High Frequency World 3* (Oct. 17, 2012) (unpublished manuscript), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1985951](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1985951) (finding that HFT reaction to hard information is stronger and faster than for soft information, which has a greater influence on price discovery in the short run, while non-HFT react more to soft news information and contribute to long-term price discovery).

75. See Fox I, *supra* note 39, at 493, 18.20 (examining how the market price will come to reflect the estimated values of informed traders).

76. See Yadav II, *supra* note 43, at 1068 (discussing the relationship between HFT and price efficiency).

77. Joseph E. Stiglitz, *Tapping the Brakes: Are Less Active Markets Safer and Better for the Economy?* 7 (Apr. 2014) (unpublished manuscript) (on file with the Federal Reserve Bank of Atlanta), <http://www.frbatlanta.org/documents/news/conferences/14fmc/Stiglitz.pdf>; see also Andrew Haldane, Exec. Dir., Fin. Stability, Bank of Eng., *Patience and Finance: Speech at the Oxford China Business Forum* (Sept. 9, 2010), <http://www.bis.org/review/r100909e.pdf> (highlighting that “[w]ith a large fraction of momentum traders, prices deviate persistently from fundamentals. Among untested investors, momentum strategies now flourish while long-term fundamentalists fail. The speculative balance of investors rises, increasing the degree of

The hypothesis that informed institutional investors' trades are anticipated by HFTs is consistent with evidence showing that directional HFT strategies (such as order anticipation), while not necessarily increasing bid-ask spreads, are reported to increase institutional investors' overall trading costs, as measured on the basis of execution shortfalls.<sup>78</sup> In fact, evidence documents a tradeoff between reduced spreads and intensive (and costly) information research.<sup>79</sup> Faster speeds reduce bid-ask spreads as one measure of transaction costs, on the one side, but crowd out fundamental research on the other side, since successful order anticipation basically entails "free-riding on the research of information-investors."<sup>80</sup> Additional evidence shows that HFTs may negatively affect fundamental price informativeness precisely due to their ability to anticipate informed order flow which, as a result, deters the gathering of fundamental information.<sup>81</sup> As regard to the providers of fundamental information, a quite large body of evidence suggests that HFT may reduce the quality of real resource allocation over the long run.<sup>82</sup> In fact, the argument goes, algorithmic trading "enhances market efficiency with respect to public information conditional on that information being revealed by other sources,"<sup>83</sup> but powerfully undermines pre-announcement information acquisition, with potentially significant welfare consequences.<sup>84</sup> Therefore, according to Weller, "[t]he same technological advances that improve price efficiency reduce the informativeness of prices in the medium run."<sup>85</sup> These findings are in line with evidence provided from

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misalignment in prices."); Robert A. Jarrow & Philip Protter, *A Dysfunctional Role of High Frequency Trading in Electronic Markets* 4 (Johnson Sch. Res. Paper Series, No. 08-2011, 2011), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1781124](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1781124) (finding that HFTs' simultaneous reaction to common signals determines deviations from fundamental value, which they exploit to their advantage).

78. See Tong, *supra* note 48, at 29–30 (discussing the HFT's impact on trading costs); Korajczyk & Murphy, *supra* note 44, at 34–35 (discussing the link between HFT and trading costs).

79. See Korajczyk & Murphy, *supra* note 44, at 35 (discussing findings on the link between spreads and research).

80. Markus Baldauf & Joshua Mollner, *High-Frequency Trade and Market Performance* 3–4 (Stanford Inst. for Econ. Pol'y Res., Working Paper No. 15-017, 2017), [https://siepr.stanford.edu/sites/default/files/publications/15-017\\_0.pdf](https://siepr.stanford.edu/sites/default/files/publications/15-017_0.pdf); Vincent van Kervel & Albert J. Menkveld, *High-Frequency Trading Around Large Institutional Orders*, J. FIN. (forthcoming) (manuscript at 5–6).

81. See Baldauf & Mollner, *supra* note 80, at 3 (discussing how order anticipation may harm efficiency).

82. Jasmin Gider et al., *High-Frequency Trading and Fundamental Price Efficiency* 7–8, 26–27 (Fin. Res. Network, Working Paper, 2016), <http://firn.org.au/wp-content/uploads/2016/05/High-frequency-trading-adn-fundamental-price-efficiency-Gider-Schmickler-Westeide.pdf> (noting that "[t]he start of HFT is associated with a substantial reduction in fundamental price efficiency that amounts to about 75% to 100% of a standard deviation for horizons of one and three years . . . [in keeping] with the notion that HFT reduces rents to information acquisition." The decrease in information acquisition activities temporarily leads to an improvement in the quality of sell-side analysts' estimates, but this effect partially recedes three to four years later. Overall, in the presence of HFT, market prices reflect "less fundamental information. Thus, the basis for real resource allocation is distorted."); see also Zhang, *supra* note 41, at 2–3 (finding that HFT is positively correlated to stock price volatility and negatively related to the market's ability to incorporate information about firm fundamentals into asset prices); Sarah Draus, *High Frequency Trading and Fundamental Trading* 2 (June 6, 2017) (unpublished manuscript), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2980875](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2980875) (demonstrating that a trader's trading strategies are strongly dependent on the type of information that the HFT can observe).

83. Brian M. Weller, *Does Algorithmic Trading Reduce Information Acquisition?*, 31 REV. FIN. STUD. 2184, 2184–85 (2017) (finding that a one standard deviation increase in algorithmic trading decreases information acquisition before earnings announcements by 9% to 13% up to a month before scheduled disclosures).

84. *Id.*

85. *Id.* at 2191.

studies on how HFTs trade while orders from institutional investors are executed, contending that HFT does not necessarily improve market quality.<sup>86</sup> Specifically, Vincent van Kervel and Albert Menkveld found that, while HFT trading in the same direction as informed investors results in the faster revelation by prices of private information,

The worrisome side effect is that, in the long run, prices could become *less* efficient. Institutional investors could discontinue costly analyst research, since informational rents have to be shared with others in the trading process. Research might no longer be privately profitable. This could become socially costly if informational externalities are large (i.e., information benefits the allocation of capital across entrepreneurs).<sup>87</sup>

### 3. *Misconduct*

Aside from the informational inequalities originating from HFTs' faster access to news feeds and trading data (which will be discussed in Part IV), it is commonly acknowledged that HFT strategies can also affect market fairness and integrity by exploiting the ability to automatically react to new information by submitting, modifying and canceling a huge number of orders within milliseconds, or even microseconds.<sup>88</sup> In fact, such an ability can facilitate various types of illicit practices that leverage on technology to unfairly distort information and prices in the marketplace.<sup>89</sup> Manipulative practices, misappropriation or other types of misconduct that HFTs may put forward when employing some trading strategies are already prohibited under U.S. as well as European law.<sup>90</sup> However, within marketplaces characterized by a significant presence of algorithmic and high-frequency traders, regulators find themselves confronted with schemes that the legal framework governing market abuse—which is in itself already difficult to define and prosecute—may not easily capture, and are increasingly challenged in terms of resources, detection and enforcement.<sup>91</sup>

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86. Kervel & Menkveld, *supra* note 80, at 59.

87. *Id.*

88. See MiFID II, *supra* note 14, at 359 (stating that “algorithmic trading or high-frequency algorithmic trading techniques can, like any other form of trading, lend themselves to certain forms of behaviour which is prohibited under Regulation (EU) No. 596/2014 [so-called Market Abuse Regulation].”).

89. See, e.g., U.K. GOV'T OFFICE FOR SCI., FORESIGHT, THE FUTURE OF COMPUTER TRADING IN FINANCIAL MARKETS 88–128 (2012) [hereinafter OFFICE FOR SCI., FORESIGHT], <https://www.gov.uk/government/publications/future-of-computer-trading-in-financial-markets-an-international-perspective> (discussing market abuse from computer-based trading).

90. See SEC Concept Release, *supra* note 4, at 3609 (discussing the types of directional strategies used); for Europe see *infra* Part III.B.2 (discussing the measures adopted by European lawmakers).

91. See *infra* Part III.A (discussing the effects of the Consolidated Audit Trail); Jacob Adrian, *Informational Inequality: How High Frequency Traders Use Premier Access to Information to Prey on Institutional Investors*, 14 DUKE L. & TECH. REV. 256, 272 (2016) (noting that that “[h]aving a fully constructed record of all market data will be very useful during the investigation of significant market events, but probably not so much otherwise. Even if the information is readily available, it will still be an arduous task for regulators to wade through the sheer volume of activity in the marketplace. While this is certainly a step in the right direction, the SEC should consider adding some form of real-time monitoring to the CAT. This could likely be accomplished with an algorithm (like the ones used by HFTs) designed to flag suspicious trading activity for immediate action. Real-time monitoring would increase the usefulness of the CAT, while reducing the amount

Although they do not necessarily, or solely, relate to HFT, technology advance has enabled those in possession of technology both to temporarily exclude traditional traders from the market through *stuffing*—submitting such a huge amount of orders as to overburden the marketplace—and to take advantage of artificial price movements which they have triggered by themselves.<sup>92</sup> This can happen through *layering*, i.e. submitting sell/buy orders at prices that are below/above value and rapidly cancelling them in order to induce other traders to sell/buy below/above value while executing hidden buy/sell orders at a favorable price;<sup>93</sup> it may also occur through *spoofing*, i.e. posting tempting orders that are almost immediately cancelled, so as to prevent their execution, thereby altering other market participants' trading behavior and taking advantage of it.<sup>94</sup> Similarly, *pinging* induces other investors to react and reveal valuable information as regards their trading intentions to the initiating party.<sup>95</sup> Another directional strategy based on technology advance is *momentum ignition*, where the trader ignites quick price movements by submitting and cancelling a series of unidirectional orders aimed at triggering other investors' order executions in order to take advantage of these by means of anticipating an early position.<sup>96</sup>

These examples are not exhaustive but make it sufficiently clear that there is a risk that traditional investors may end up dealing with counterparties that—due to their superior technology infrastructure—are capable of unfairly overwhelming them.<sup>97</sup>

### III. THE REGULATORY APPROACH TO HFT IN THE U.S. AND THE EU

Based on this general background, U.S. and European regulators have been induced to take broader regulatory action with a view to ensuring orderly equity markets and preventing market abuse, which comprise measures applicable directly or indirectly to HFT.<sup>98</sup> Unsurprisingly, due to the main focus of the scholarship on these aspects, regulatory action in both the U.S. and the EU

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of time regulators have to spend wading through the audit trail.”). *See generally* Tom C.W. Lin, *The New Market Manipulation*, 66 EMORY L.J. 1253, 1294–03 (2017) [hereinafter Lin II] (discussing the regulatory challenges of resources, detection, and enforcement). With reference to derivatives markets, *see* Gregory Scopino, *Do Automated Trading Systems Dream of Manipulating the Price of Futures Contracts? Policing Markets for Improper Trading Practices by Algorithmic Robots*, 67 FLA. L. REV. 221, 242–46 (2015) (discussing regulatory challenges with respect to derivative markets). As to oversight and investigation, it remains to be seen whether the SEC will effectively become better equipped following the implementation of the Consolidated Audit Trail.

92. Scopino, *supra* note 91, at 229–30, 230 n.38.

93. *Id.*

94. *Id.*

95. Adrian, *supra* note 91, at 263.

96. *Id.* at 258 n.17.

97. *See* Lin II, *supra* note 91, at 1290 (noting that “[h]igh-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.”).

98. For the U.S. *see generally* Hilary J. Allen, *The SEC as Financial Stability Regulator*, J. CORP. L. (forthcoming) (manuscript at 10–21) (noting that SEC has adapted to innovations in HFT by adopting regulations aimed at insuring financial stability); for Europe *see generally* ESMA ORDER DUPLICATION, *supra* note 9, at 5 (noting the adoption of the market in financial instruments directive (MiFID) as a response to HFT).

appears to be chiefly concerned with the issues of market stability and integrity, while neglecting those pertaining to price efficiency and, specifically, the impact of HFT on price discovery in the medium and long-run.<sup>99</sup>

A. *The Unfinished Path Towards Regulating HFT in the U.S.*

With regard to automated trading in general, the most significant steps taken by the SEC to prevent instability in the equities markets<sup>100</sup> led to the adoption of the so-called Market Access Rule on November 3, 2010,<sup>101</sup> and the Regulation Systems Compliance and Integrity (Reg SCI) on November 19, 2014.<sup>102</sup>

The new Rule 15c3-5 adopted under the Exchange Act prohibits brokers and dealers with direct access to trading securities on exchanges or ATSS from providing their customers with unfiltered or “naked” access to those markets, including the so-called practice of “sponsored” access, and requires them: (1) to implement risk management controls and supervisory procedures that are reasonably designed to systematically limit the financial exposure that could arise as a result of market access;<sup>103</sup> (2) to ensure compliance with all regulatory requirements applicable in connection with market access;<sup>104</sup> (3) to prevent the entry of orders that exceed appropriate pre-set credit or capital thresholds, or that appear to be erroneous;<sup>105</sup> (4) to prevent the entry of orders unless there has been compliance with all regulatory requirements that must be satisfied on a pre-order entry basis;<sup>106</sup> (5) and to prevent the entry of orders that the broker or dealer or customer is restricted from trading.<sup>107</sup>

Reg SCI is intended to strengthen the technology infrastructure of securities markets by means of rules designed to reduce the occurrence of systems issues, improve resiliency when systems problems occur, and enhance SEC oversight and enforcement of technology infrastructure.<sup>108</sup> Specifically, “SCI entities” (self-regulatory organizations, certain alternative trading systems, disseminators of consolidated market data—so-called plan processors, and certain exempt clearing agencies) are required to carefully design, develop, test, maintain and monitor the systems that support their operations, which comprise

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99. For the U.S. *see generally* Allen, *supra* note 98, at 39–40 (arguing that the SEC has a mandate to promote financial stability).

100. As regards the U.S. derivatives market, the issue of automation has also been addressed by the CFTC which, after publishing its Concept Release on Risk Controls and System Safeguards for Automated Trading Environments, on December 17, 2015 proposed the adoption of Regulation Automated Trading, a unified body of law addressing automation in order placement and execution to reduce risk and increasing transparency in automated trading. 78 Fed. Reg. 56542 (Sept. 12, 2013); 80 Fed. Reg. 78824 (Dec. 17, 2015) (notice of proposed rulemaking); 81 Fed. Reg. 85334 (Nov. 25, 2016) (supplemental notice of proposed rulemaking).

101. Risk Management Controls for Brokers or Dealers with Market Access, Exchange Act Release No. 63241, 75 Fed. Reg. 69792 (Nov. 15, 2010).

102. Regulation Systems Compliance and Integrity, Exchange Act Release No. 73639, 79 Fed. Reg. 72252 (Dec. 5, 2014).

103. 17 C.F.R. § 240.15c3-5(c)(1) (2018).

104. *Id.* § 240.15c3-5(c)(2).

105. *Id.* § 240.15c3-5(c)(1)(1).

106. *Id.* § 240.15c3-5(c)(2)(i).

107. *Id.* § 240.15c3-5(c)(2)(ii).

108. Regulation Systems Compliance and Integrity, 79 Fed. Reg. at 72,252.

the six key securities market functions—trading, clearance and settlement, order routing, market data, market regulation, and market surveillance.<sup>109</sup>

Furthermore, in response to the May 2010 equity market disruption, in 2012 the SEC and the securities industry implemented revised market-wide circuit breakers, as well as a “limit up-limit down” tool, which was specifically aimed at better controlling price volatility for individual securities.<sup>110</sup>

In addition to strengthening the market’s stability and resilience by reinforcing broker-dealer risk controls and enhancing market infrastructure robustness and operational integrity, in 2014 the SEC announced its willingness to address HFT by confronting aggressive, potentially destabilizing short term trading strategies in vulnerable market conditions “with an anti-disruptive trading rule,” whilst also strengthening the firms’ risk management of algorithms, and enhancing oversight over their use.<sup>111</sup> However, no such HFT-specific measure has as yet been adopted.<sup>112</sup>

What is more, in order to increase oversight, the SEC is willing to bring active unregistered proprietary traders (as are some HFTs) under the scope of its dealer rules and, in parallel, to remove an exception to the requirement of membership of a self-regulatory association for dealers that trade on off-exchange markets.<sup>113</sup> On March 25, 2015, the Commission proposed an amendment to Rule 15 b9-1 adopted under the Exchange Act by which any firm trading on off-exchange markets, albeit not carrying any customer accounts, would be required to register with a self-regulatory association (currently only the Financial Industry Regulatory Authority) unless it chooses to trade solely on the exchange of which it is a member.<sup>114</sup> Consequently, many firms that engage in HFT strategies (only or also) on off-exchange markets currently falling under the *de minimis* allowance, which is due to be eliminated and replaced by new, more limited exemptions, would be subject to FINRA regulation, supervision, and compliance enforcement.<sup>115</sup> Meantime, FINRA is willing to implement more regulations addressing market manipulation and volatility associated with HFT, and issued guidance on supervision and control practices for algorithmic

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109. *Id.* at 72, 272.

110. Joint Industry Plans; Order Approving, on a Pilot Basis, the National Market System Plan to Address Extraordinary Market Volatility by BATS Exchange Inc. et al., Exchange Release Act No. 67091, 77 Fed. Reg. 33,500 (June 6, 2012) [hereinafter Approval Order]. The original text of the Plan is annexed to the Approval Order as Exhibit A (“The Plan”). Subsequent amendments are available at <https://www.sec.gov/rules/sro/nms.htm>.

111. See White I, *supra* note 14, Part III (explaining additional initiatives relating to algorithmic trading); Mary Jo White, Chair, Sec. & Exch. Comm’n, Keynote Address at the Securities Traders Association: Equity Market Structure in 2016 and for the Future, n.13 (Sept. 14, 2016) [hereinafter White II], <https://www.sec.gov/news/speech/white-equity-market-structure-2016-09-14.html>.

112. White I, *supra* note 14; White II, *supra* note 111.

113. Exemption for Certain Exchange Members, Exchange Act Release No. 74581, 80 Fed. Reg. 18,036, 18,042 (to be codified at 17 C.F.R. pt. 240) (showing that, based on Rule 15b9-1, around 125 broker-dealers are exempt from FINRA registration, accounting for 48% of orders submitted to off-exchange markets in 2014).

114. *Id.*

115. *Id.* at 18,045.

trading strategies, which focuses on the development, testing and production of trading algorithms.<sup>116</sup>

The SEC has also recognized that available evidence regarding the actual impact of HFT on market stability and manipulation is not comprehensive or unambiguous, and that more information is required in order to enable accurate analysis.<sup>117</sup> Accordingly, on July 11, 2012, the Commission adopted Rule 613 of Reg NMS, requiring self-regulatory organizations to submit a joint plan to create, implement, and maintain a Consolidated Audit Trail designed to track order event information efficiently and accurately for orders for NMS securities across all markets within a single consolidated data source.<sup>118</sup> The CAT NMS Plan is intended to provide the data needed for full analysis and to serve as a basis for the future regulatory investigation of illegal activities, such as insider trading and market manipulation, as well as potentially more targeted action.<sup>119</sup> The CAT NMS Plan filed by participant self-regulatory organizations on February 27, 2015, as later amended, was approved by the Commission on November 15, 2016,<sup>120</sup> and is currently in the process of implementation.<sup>121</sup>

Finally, the SEC is working with equities exchanges and FINRA to address its fairness and efficiency concerns with regard to latency issues associated with both co-location and differences between direct and consolidated market data feeds.<sup>122</sup> Specifically, efforts are under consideration in order to ensure that exchanges do not transmit data directly to customers any sooner than they do to a Securities Information Processor (SIP), and that technology used for transmitting data to the SIP and to direct feeds is on a par, as well as to enhance the transparency of exchanges in terms of how, and for what specific purpose, they use data feeds.<sup>123</sup> In addition, possible measures under examination include mechanisms designed to minimize speed advantages, such as frequent batch auctions for trading, or speed bumps, as well as affirmative or negative

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116. See FIN. INDUS. REG. AUTH., REGULATORY NOTICE 15-06: REGISTRATION OF ASSOCIATED PERSONS WHO DEVELOP ALGORITHMIC TRADING STRATEGIES 2–5 (Mar. 2015), [http://www.finra.org/sites/default/files/notice\\_doc\\_file\\_ref/Notice\\_Regulatory\\_15-06.pdf](http://www.finra.org/sites/default/files/notice_doc_file_ref/Notice_Regulatory_15-06.pdf) (explaining initiatives designed to increase the scope of trading information FINRA receives and to help provide market participants and investors with more transparency); FIN. INDUS. REG. AUTH., REGULATORY NOTICE 15-09: EQUITY TRADING INITIATIVES: SUPERVISION AND CONTROL PRACTICES FOR ALGORITHMIC TRADING STRATEGIES 5–7 (Mar. 2015), [https://www.finra.org/sites/default/files/notice\\_doc\\_file\\_ref/Notice\\_Regulatory\\_15-09.pdf](https://www.finra.org/sites/default/files/notice_doc_file_ref/Notice_Regulatory_15-09.pdf) (suggesting effective practices for firms engaging in algorithm strategies).

117. Consolidated Audit Trail, Exchange Act Release No. 67457, 77 Fed. Reg. 45722 (Aug. 1, 2012) (to be codified at 17 C.F.R. pt. 242).

118. *Id.*

119. *Id.*

120. Joint Industry Plan; Order Approving the National Market System Plan Governing the Consolidated Audit Trail, Exchange Act Release No. 79318, 81 Fed. Reg. 84,696 (Nov. 23, 2016).

121. Developments can be followed on <http://www.catnmsplan.com>.

122. Sarah N. Lynch, *New York Stock Exchange to Pay \$4.5 Million to Settle SEC Charges*, REUTERS (May 1, 2014, 10:56 AM), <https://www.reuters.com/article/us-nyse-sec-enforcement/new-york-stock-exchange-to-pay-4-5-million-to-settle-sec-charges-idUSBREA400LA20140501> (“Part of the SEC’s focus has been on the relationships between high-speed trading firms and exchanges, including services the exchanges provide such as co-location and access to direct data feeds.”).

123. See White I, *supra* note 14, Part III (discussing methods of achieving greater investor fairness by increasing the robustness and resilience of SIPs).

obligations for HFTs “analogous to the ones that historically applied to the proprietary traders with time and space advantages on manual trading floors.”<sup>124</sup>

### B. *The Two-Pronged European HFT Regime*

Regulatory measures recently adopted at European level clearly show that the overall EU approach to HFT is not as different as the one on the other side of the Atlantic, and that the scope of the measures identified on each side of the Atlantic substantially converges.<sup>125</sup> Still, differences may be seen in two respects. While European lawmakers have addressed HFT-related market manipulation in a way that is perhaps more direct than the SEC, the latter is considering a possible review of the rules relevant for latency arbitrage, a step that, by contrast, is not being considered in the EU.<sup>126</sup>

#### 1. *Enhancing Equity Market Stability and Resilience*

Along with the European Securities and Markets Authority’s guidelines on automated trading, released in February, 2012,<sup>127</sup> which include the use of trading algorithms by investment firms for dealing on their own account or on behalf of clients, MiFID II provisions address HFT firms’ internal organization as a means of enhancing their ability to adequately face and manage risks associated with algorithmic trading.<sup>128</sup> What is more, parallel provisions consolidate the role of exchanges within the oversight framework for financial markets in order to ensure the system’s resilience, stability, and reliability, and to enhance scrutiny on HFT by supervisory authorities, which are empowered to force increased information and control.<sup>129</sup>

Specifically, in order to avoid HFTs endangering market stability and orderly trading, Article 17(1) of MiFID II requires investment firms that engage in algorithmic trading (of which HFT is a subset) to put in place effective systems and risk controls suitable to the business they operate in order to ensure that their trading systems are resilient and have sufficient capacity, are subject to appropriate trading thresholds and limits, and prevent the sending of erroneous orders or any other functioning of the systems in a way that may create

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124. *Id.*

125. Tilen Čuk & Arnaud Van Waeyenberge, *European Legal Framework for Algorithmic and High Frequency Trading (Mifid 2 and MAR): A Global Approach to Managing the Risks of the Modern Trading Paradigm*, 9 EUR. J. RISK REG. 146–53 (2018).

126. See Čuk & Van Waeyenberge, *supra* note 125, at 146–53 (showing that European regulators are not considering a possible review of rules relevant for latency arbitrage).

127. EUR. SEC. MKTS. AUT., SYSTEMS AND CONTROLS IN AN AUTOMATED TRADING ENVIRONMENT FOR TRADING PLATFORMS, INVESTMENT FIRMS AND COMPETENT AUTHORITIES (Feb. 24, 2012), [https://www.esma.europa.eu/sites/default/files/library/2015/11/esma\\_2012\\_122\\_en.pdf](https://www.esma.europa.eu/sites/default/files/library/2015/11/esma_2012_122_en.pdf).

128. Čuk & Van Waeyenberge, *supra* note 125, at 149; DECHERT LLP, MIFID II: GOVERNANCE AND ORGANISATION (Oct. 30, 2017), <https://www.dechert.com/content/dam/dechert%20files/hot-topics/MiFID%20II%20-%20Governance%20and%20organisation.pdf> (discussing the organization requirements under MiFID II).

129. Čuk & Van Waeyenberge, *supra* note 125, at 151–52; European Commission Statement, Financial Markets Regulatory Dialogue Joint Statement (July 8, 2014) (describing how the U.S. and European Union met to keep an open dialogue about HFT regulation).

or contribute to a disorderly market.<sup>130</sup> These provisions have been operationally transposed into a number of detail measures adopted in Commission Delegated Regulation (EU) 2017/589 of July 19, 2016 supplementing MiFID II.<sup>131</sup>

The need to ensure orderly trading on regulated markets is also consistent with the duty now imposed by Article 17(3) MiFID II upon investment firms that engage in algorithmic trading for the purpose of pursuing a market making strategy to carry out this market making continuously during a specified proportion of the venue's trading hours, except under exceptional circumstances, and therefore to provide liquidity on a regular and predictable basis to the trading venue.<sup>132</sup>

Investment firms engaging in algorithmic trading are furthermore to be subject to enhanced scrutiny from supervisory authorities.<sup>133</sup> According to Article 17(2) MiFID II, these firms are not only required to provide required information to the competent authorities of their home Member State and to those of the trading venue at which they engage in algorithmic trading.<sup>134</sup> The competent authority may also require the firm to provide, "on a regular or ad-hoc basis, a description of the nature of its algorithmic trading strategies, details of the trading parameters or limits to which the system is subject, the key compliance and risk controls that it has in place to ensure the conditions laid down in paragraph 1 are satisfied, and details of the testing of its systems."<sup>135</sup> The competent authority "may, at any time, request further information from a firm concerning its algorithmic trading and the systems used for that trading."<sup>136</sup>

In order to enhance the capacity of financial markets to offer stable and reliable trading conditions, Article 48 MiFID II is intended to increase the role of exchanges within the oversight framework for financial markets.<sup>137</sup> Article 48 introduces specific provisions concerning the systems' resilience, as well as

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130. Ćuk & Van Waeyenberge, *supra* note 125, at 149–50; MiFID II, *supra* note 14, at 398.

131. Commission Regulation (EU) 2017/589, Supplementing Directive 2014/65/EU of the European Parliament and of the Council as Regards Organisational Requirements and Operating Conditions for Investment Firms and Defined Terms for the Purposes of that Directive, 2017 J.O. (L 87) 417. Alongside general organizational requirements and governance arrangement that investment firms are required to establish for the purposes of monitoring its trading systems and algorithms, including clear lines of accountability, effective procedures for the communication of information and a separation of tasks and responsibilities, in order to ensure the resilience of trading systems, Regulation 2017/589 provides for testing and the deployment of trading algorithms systems and strategies based on the potential impact that those algorithms may have on the overall fair and orderly functioning of the market. The controlled deployment of trading algorithms is intended to ensure that trading algorithms perform as expected in a production environment. The investment firm is further required to: establish an effective "kill functionality" that allows for the withdrawal of all or some of its orders where this becomes necessary; establish and maintain an automated surveillance system which effectively monitors orders and transactions and generates alerts and reports; put in place business continuity arrangements that effectively deal with disruptive incidents and ensure a timely resumption of the algorithmic trading; monitor its algorithmic trading activity in real time; carries out pre-trade controls on order entry as well as post-trade controls. Finally, Regulation 2017/589 requires HFTs to record the details of each order submitted according to a predefined format and to keep those records for five years from the date of order submission.

132. MiFID II, *supra* note 14, at 399.

133. *Id.*

134. *Id.* at 398–99.

135. *Id.* at 399.

136. *Id.*

137. *Id.* at 432.

circuit breakers, i.e. systems and procedures designed to ensure (by limiting excessive order flows, and rejecting orders that exceed pre-determined volume and price thresholds or are clearly erroneous) that algorithmic trading, including HFT, does not compromise orderly trading.<sup>138</sup> Article 48 calls on Member States to require a regulated market to put in place effective systems, procedures, and arrangements to ensure that its trading systems are resilient, have sufficient capacity to deal with peak order and message volumes, are able to ensure orderly trading under conditions of severe market stress, are fully tested to ensure such conditions are met and are subject to effective business continuity arrangements to ensure continuity of its services if there is any failure of its trading systems.<sup>139</sup>

## 2. *Preventing Market Abuse*

Misconduct concerns have further prompted the European lawmaker to adopt measures that seek to enhance market integrity by explicitly broadening and specifying the definition of market manipulation, so as to capture various forms of aggressive practices pursued by HFTs.<sup>140</sup>

The existing definition of market manipulation, provided by Articles 4 and 5 of Directive 2003/124/EC,<sup>141</sup> is already sufficiently wide as to include the manipulative behavior associated with HFT.<sup>142</sup> However, in order to provide for sharper discipline, Article 12(2)(c) of Regulation No. 96/2014/EU concerning market abuse now explicitly refers to a number of strategies based upon algorithmic trading and HFT that are regarded as market manipulation.<sup>143</sup> Moreover, recital 38 MAR states that the “Regulation should provide measures regarding market manipulation that are capable of being adapted to new forms of trading or new strategies that may be abusive.”<sup>144</sup> Therefore, the examples provided in the definition of market manipulation of specific abusive strategies that may be carried out (also) by means of algorithmic and high-frequency trading “are neither intended to be exhaustive nor intended to suggest that the same strategies carried out by other means would not also be abusive.”<sup>145</sup>

Accordingly, pursuant to Article 12(2)(c) MAR, the placing, cancelling or modifying of orders by electronic means, thereby (i) disrupting or delaying the functioning of the trading system, (ii) making it more difficult for other persons to identify genuine orders, including by overloading or destabilizing the order book, and (iii) creating false or misleading signals about the supply of, or demand for, or price of, a financial instrument, in particular by entering orders

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138. *Id.* at 432–33.

139. *Id.* at 431.

140. Commission Directive 2003/124/EC of 22 December 2003 Implementing Directive 2003/6/EC of the European Parliament and of the Council as regards the Definition and Public Disclosure of Inside Information and the Definition of Market Manipulation O. J. (L 339) 70.

141. *Id.* at 70–71.

142. OFFICE FOR SCL., FORESIGHT, *supra* note 89, at 93.

143. Commission Regulation 596/2014 of the European Parliament and of the Council of 16 April 2014 on Market Abuse (Market Abuse Regulation) and Repealing Directive 2003/6/EC of the European Parliament and of the Council and Commission Directives 2003/124/EC, 2003/125/EC and 2004/72/EC O.J. (L 173) 8 [hereinafter MAR].

144. *Id.*

145. *Id.*

to initiate or exacerbate a trend, shall be considered as market manipulation, to the extent such behavior has the effect of (a) giving false or misleading signals as to the supply of, demand for, or price of, a financial instrument, (b) securing the price of financial instruments at an abnormal or artificial level, or (c) affecting the price of financial instruments by employing a fictitious device or any other form of deception or contrivance, and (d) such behavior is not carried out for legitimate reasons, and does not conform with an accepted market practice.<sup>146</sup>

#### IV. HOW HFT-RELATED INFORMATIONAL INEQUALITIES CAN THREATEN EQUITY MARKETS' (LONG-TERM) EFFICIENCY

Part III has shown that, both in the U.S. and Europe, regulatory action directly and indirectly capturing algorithmic and HFT has prioritized the prevention of new market crashes and has reined in strategies relying on HFT that is regarded either as manipulative or disruptive for stability.

However, regulatory intervention has failed to consider more closely the growing body of research—discussed in Part II.B.2—showing that HFT can impair long-term market efficiency, and the question as to whether the existing rules on public disclosures by issuers and insider trading are able to curb these negative effects.<sup>147</sup> The choice not to intervene (at least not until now) in this area may possibly be explained by research showing that HFT positively affects short-term price discovery.<sup>148</sup> Nevertheless, concerns have been expressed at this view based on the recognition that there are various market practices that enable HFTs to access information earlier than other investors, in contrast with the principle of equal access to information that underpins—although in different manners—financial markets regulation both in the U.S. and the EU.<sup>149</sup> In fact, the structural advantage in processing information gained by HFTs due to their sophisticated (and costly) technological infrastructures may partially disincentivize fundamental informed trading by other investors and affect disclosure-based allocative market efficiency, as depicted in the ECMH.<sup>150</sup>

Against this background, the rest of this Article focuses on trading strategies which can be detrimental for price efficiency in the longer run, in order to draw a framework on how possibly to contrast the negative impacts of HFT on market efficiency. Specifically, the characteristic features of HFT in terms of the volume, speed and extremely low latency allow HFTs for latency

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146. *Id.* at 29–30.

147. *See supra* Part II.B.2 (investigating how HFT affects price accuracy).

148. *Id.* (discussing how scholars suggest that HFT “boosts the process by which information is incorporated into prices” which “benefit[s] investors as a whole.”).

149. Yadav II, *supra* note 43, at 1068.

150. *See generally* Eugene F. Fama, *Efficient Capital Markets: A Review of Theory and Empirical Work*, 25 J. FIN. 373, 383–417 (1970) (discussing the efficient markets model); Ronald J. Gilson & Reinier H. Kraakman, *The Mechanisms of Market Efficiency*, 70 VA. L. REV. 549, 569–72 (1984) (discussing professionally informed trading); Zohar Goshen & Gideon Parchomovsky, *The Essential Role of Securities Regulation*, 55 DUKE L.J. 711, 732–55 (2006) (explaining the structural advantage inherent in HFTs in processing information, and its unintended effect in partially discouraging information sharing among investors).

arbitrage-based anticipation of informed order flow.<sup>151</sup> According to Stiglitz and further scholarship,<sup>152</sup> trading ahead of the predicted institutional order flow can reduce returns on investing in real economy information for other market players and negatively impact allocative market efficiency.<sup>153</sup>

In the following analysis, we leave aside manipulative practices (which may also occur, but are already prohibited under U.S. and European law) and assume that HFT latency arbitrage and order anticipation do not entail misconduct; still, the legitimate technology-driven advantage of HFTs can negatively affect market efficiency as a result of information inequalities associated with HFT's early access to corporate and market data, which can lower the incentive of informed traders to perform costly fundamental analysis.<sup>154</sup>

#### A. *Early Access by HFTs to Corporate Information and Market Data*

The principle of equal access to information is widely regarded as a cornerstone of financial markets regulation.<sup>155</sup> Although differences among jurisdictions exist, disclosure and insider trading rules still in general aim to ensure parity of information between investors.<sup>156</sup> Within the European legal context, the main role played by this principle very clearly proceeds from the market abuse regime laid down by the MAR.<sup>157</sup> Specifically, as recital 24 MAR explicitly states,

The question whether a person has infringed the prohibition on insider dealing or has attempted to commit insider dealing should be analysed in the light of the purpose of this Regulation, which is to protect the integrity of the financial market and to enhance investor confidence, which is based, in turn, on the assurance that investors will be placed on an equal footing and protected from the misuse of inside information.<sup>158</sup>

According to this principle, Article 17 MAR imposes an obligation on an issuer to disclose inside information promptly, requiring it to “inform the public

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151. SEC Concept Release, *supra* note 4, at 3608; *High-Frequency Trading (HFT)*, FXCM: MARKET INSIGHTS, <https://www.fxcm.com/insights/high-frequency-trading-hft/> (last visited Sept. 20, 2018) (“Opportunity arising from various market participants receiving market information at different times is known as ‘latency arbitrage.’ Essentially, this is the ability to receive and process market-pertinent data before competitors can react appropriately to the changing market conditions.”).

152. *See supra* Part II.B.2 (investigating how HFT affects price accuracy).

153. Stiglitz, *supra* note 77, at 7.

154. Yadav II, *supra* note 43, at 1068.

155. *See* McNamara, *supra* note 17, at 143 (quoting Zachary J. Gubler, *Reconsidering the Institutional Design of Federal Securities Regulation*, 56 WM. & MARY L. REV. 409, 424–26 (2014) (noting that among the motivating principles for the Congress to enact securities laws was concern for fairness and a level playing field)).

156. *See generally* Lars Klöhn, *The European Insider Trading Regulation after Spector Photo Group*, 7 EUR. COMPANY & FIN. L. REV. 347, 358–59 (2010) (examining the ECJ's Spector decision and its implications for the EU).

157. MAR, *supra* note 143, at 5; *see also* Klöhn, *supra* note 156, at 359 (“market egalitarianism is a principle of formal equality and not of material equality.”).

158. MAR, *supra* note 143, at 5.

as soon as possible of inside information which directly concerns that issuer.”<sup>159</sup> Article 8 MAR then lays down an absolute prohibition on insider dealing, according to which inside information cannot be used by those possessing it “by acquiring or disposing of, for [their] own account or for the account of a third party, directly or indirectly, financial instruments to which that information relates.”<sup>160</sup> In keeping with the theory of equal access to information, the prohibition on trading based on material non-public information laid down by the MAR is absolute in nature, irrespective of how such information is obtained.<sup>161</sup> Moreover, according to Article 8(4) MAR, the enforcement of insider trading rules only requires proof that the recipient of the information knew, or ought to have known, that the information constituted inside information.<sup>162</sup>

The reach of the theory of equal access to information is less unambiguous under the U.S. insider trading regulatory framework set out in Section 10(b) of the Exchange Act<sup>163</sup> and Rule 10b-5.<sup>164</sup> Having been originally asserted in *In re Cady, Roberts & Co.*<sup>165</sup> and *SEC v. Texas Gulf Sulphur Co.*,<sup>166</sup> the principle was later partly rejected in *Chiarella v. United States*<sup>167</sup> and *United States v. O'Hagan*,<sup>168</sup> which relativized information equality by stating that the possession of material inside information cannot alone create a duty to disclose or abstain, and that a duty to disclose only exists where a fiduciary duty is owed to the shareholders of the corporation whose securities are traded (according to the classical theory), or to the source of the information (according to the misappropriation theory).<sup>169</sup> However, as many scholars noted,<sup>170</sup> subsequent cases came back to embrace the equal access doctrine “by often finding the violation of a *Chiarella/O'Hagan* duty to occur in any case where the information has been obtained improperly.”<sup>171</sup>

Despite some ambiguity within the case law, the principle of equal access to information appears to be well-established within U.S. securities regulation.<sup>172</sup> Although (in contrast to the EU regime) there is no general

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159. *Id.* at 34.

160. *Id.* at 25.

161. *Id.*

162. *Id.*

163. Now codified as 15 U.S.C. § 78j(b) (2012).

164. 17 C.F.R. § 240.10b-5 (2012).

165. 40 S.E.C. 907 (1961).

166. 401 F.2d 833, 848 (2d. Cir. 1968) (highlighting that the disclose or abstain rule “is based in policy on the justifiable expectation of the securities marketplace that all investors trading on impersonal exchanges have relatively equal access to material information.”).

167. 445 U.S. 222, 232 (1980).

168. 521 U.S. 642, 658 (1997).

169. *E.g.*, Donna M. Nagy, *Insider Trading and the Gradual Demise of Fiduciary Principles*, 94 IOWA L. REV. 1315, 1322–36 (2009) (discussing the classical theory and misappropriation theory).

170. *Id.* at 1315; *see also* Stephen Bainbridge, *Regulating insider trading in the post fiduciary duty era: equal access or property rights?*, in RESEARCH HANDBOOK ON INSIDER TRADING 80, 86–90 (Stephen M. Bainbridge ed., 2013) (examining the regulation of insider trading in the post-fiduciary era).

171. Mercer Bullard, *Insider Trading in a Mannean Marketplace*, 88 TEMP. L. REV. 223, 236 (2016).

172. 17 C.F.R. §§ 243.100–243.103 (2012).

requirement to disclose information as soon as it becomes material,<sup>173</sup> the SEC positively requires the disclosure by issuers of material information with regard to a wide list of events, requiring them to file a Form 8-K “on a rapid and current basis.”<sup>174</sup> Along these lines, in 2004, the Commission adopted new rules to increase the frequency of disclosures with regard to certain key corporate events.<sup>175</sup>

The principle of equal access to information is also at the roots of Regulation Fair Disclosure (Reg FD),<sup>176</sup> which is explicitly referred to as pursuing the aim of providing all investors with equal access to information.<sup>177</sup> Specifically, Reg FD requires public companies to make their disclosures of material, not-yet-public information available to all potential investors at precisely the same time.<sup>178</sup> Thus, as has been recognized by Commissioner Laura S. Unger,<sup>179</sup> Reg FD can be viewed as an application of the theory of equal access to information.<sup>180</sup>

The principle of equal access to information seems to be partially reconsidered in the HFT era, where trades are executed at (almost) light-speed.<sup>181</sup> In such an accelerated context, a minimum time advantage in accessing market-moving information can translate into significant profits and distort financial markets.<sup>182</sup> As Kevin Haeberle and M. Todd Henderson have noted,<sup>183</sup> the rise of ultra-fast investors in the financial market arena has put under the spotlight a new area of law (which they call “information-dissemination law”) concerning how market-moving information is revealed to

173. See John Armour et al., *Investor Choice in Global Securities Markets* 57–58 (Eur. Corp. Governance Inst., Law Working Paper No. 371/2017, 2017), <https://ssrn.com/abstract=3047734> (discussing the requirements for disclosing information in the U.S. and EU).

174. Sarbanes-Oxley Act of 2002, Pub. L. No. 107–204, 116 Stat. 745.

175. See *infra* Part V.B.2 (discussing mandatory disclosure obligations).

176. 17 C.F.R. §§ 243.100–243.103 (2012).

177. See LAURA S. UNGER, SEC. & EXCH. COMM’N, SPECIAL STUDY: REGULATION FAIR DISCLOSURE REVISITED (Dec. 6, 2001) [hereinafter UNGER, SPECIAL STUDY], <http://www.sec.gov/news/studies/regfdstudy.htm> (examining Regulation Fair Disclosure).

178. See generally Kevin S. Haeberle & M. Todd Henderson, *Information-Dissemination Law: The Regulation of How Market-Moving Information is Revealed*, 101 CORNELL L. REV. 1373, 1386 (2016) (explaining the implications of the simultaneous dissemination requirement).

179. See UNGER, SPECIAL STUDY, *supra* note 177 (noting that “the regulation has accomplished its goal of equal access to information”); see also Jill Fisch, *Regulation FD: An Alternative Approach to Addressing Information Asymmetry*, in RESEARCH HANDBOOK ON INSIDER TRADING 112 (Stephen Bainbridge ed., 2013) (illustrating that Regulation FD “took an alternative approach to information asymmetry that was not grounded in theories of fraud but, instead, in issuer disclosure obligations. Specifically, the Rule focuses on corporate issuers and corporate officials as the source of such asymmetries, reasoning that if selective disclosures by corporate insiders could be prevented at the source, regulators would have less need to address trading by the recipients of that information”); Marc I. Steinberg, *Insider Trading, Selective Disclosure, and Prompt Disclosure: A Comparative Analysis*, U. PA. J. INT’L ECON. L. 635, 650–51 (2001) (discussing the scope of Reg FD); Yesha Yadav, *Insider Trading and Market Structure*, 63 UCLA L. REV. 968, 1006–1007 (2016) [hereinafter Yadav III] (“[J]ust as *Chiarella* scaled back liability through the requirement of a fiduciary duty under Rule 10b-5 and extinguished the place of equal access in insider trading jurisprudence, Reg FD returns it, in part, back into regulation.”).

180. UNGER, SPECIAL STUDY, *supra* note 177.

181. See *High Frequency and Algo Trading Are Taking Over Markets — What It Means for You*, CITY FALCON (Aug. 21, 2017), <https://www.cityfalcon.com/blog/investing-for-newbies/high-frequency-algo-trading-taking-over> (explaining the mechanics of HFT).

182. *Id.*

183. Haeberle & Henderson, *supra* note 178, at 1384–97.

the market.<sup>184</sup> In an HFT world, information asymmetry, and breaches of insider trading rules, can arise in a manner hardly conceivable in past times.<sup>185</sup> As stated by the former New York State Attorney General (NYAG) Eric T. Schneiderman in 2013, “[s]mall but powerful groups within the market are able to use soon to be public information combined with high frequency trading in a way that distorts our markets far more than Albert Wiggin or Ivan Boesky or even Gordon Gekko could ever have imagined.”<sup>186</sup>

### 1. *Insider Trading 2.0*

As far as issuers’ public disclosures are concerned, this state of affairs first became apparent following the NYAG’s “Insider Trading 2.0” investigation<sup>187</sup> focusing on early access to information feeds released by financial data providers.<sup>188</sup> The investigation was specifically triggered by concerns over Thomson Reuters’ partnership with the University of Michigan relating to the release of revisions to its well-known Index of Consumer Sentiment which, due to its informativeness regarding consumer views on economic trends, is in fact capable of moving the markets.<sup>189</sup> Thomson Reuters undertook to pay the University of Michigan about \$1m per year for exclusive access to its data in return for the right to act as the exclusive disseminator of index updates, and in 2008 started to offer investors the opportunity to pay a fee in order to receive index revisions five minutes before they were released to the general public.<sup>190</sup> However, for a substantial extra fee (reportedly as much as \$6,000 per month), Thomson Reuters also started to sell to an elite group of clients the opportunity to access data two seconds ahead of other subscribers.<sup>191</sup> This two-second time advantage, which may seem minimal, allowed HFTs to earn significant profits.<sup>192</sup> According to press reports,<sup>193</sup> following pressure from the NYAG, Thomson Reuters decided to suspend its early-access service in 2013.<sup>194</sup>

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184. *Id.*

185. See Eric T. Schneiderman, N.Y. Att’y Gen., Remarks at the 2013 Bloomberg Markets 50 Summit (Sept. 24, 2013), <https://ag.ny.gov/press-release/remarks-attorney-general-eric-t-schneiderman-2013-bloomberg-markets-50-summit> (explaining how HFT creates new opportunities for information asymmetry and insider trading to arise).

186. *Id.*

187. *Id.*

188. *Id.*

189. See DONALD C. LANGEVOORT, *SELLING HOPE, SELLING RISK: CORPORATIONS, WALL STREET AND THE DILEMMAS OF INVESTOR PROTECTION* 82–84 (2016) (discussing how the release of surveys by the University of Michigan are market-moving); James J. Angel & Douglas M. McCabe, *Insider Trading 2.0? The Ethics of Information Sales*, 147 J. BUS. ETHICS 747, 748–50 (2017) (discussing the University of Michigan Survey of Consumer Sentiment).

190. Schneiderman, *supra* note 185.

191. *Id.*

192. *Id.*

193. See David McLaughlin, *Thomson Reuters to Suspend Early Data Survey Release*, BLOOMBERG (July 8, 2013), <https://www.bloomberg.com/news/articles/2013-07-08/thomson-reuters-said-to-be-probed-by-n-y-over-index> (discussing Thomas Reuters Corp.’s agreement with New York Attorney General’s Office); Arash Massoudi & Andrew Edgecliffe-Johnson, *Financial Information Groups Face NY Probe*, FIN. TIMES (July 8, 2013), <https://www.ft.com/content/85af40be-e7c3-11e2-babb-00144feabdc0> (noting the investigation of financial data providers).

194. Schneiderman, *supra* note 185.

In 2014, NYAG announced that it had reached similar agreements with the leading news distribution and reporting firms Marketwired and Business Wire, which had committed to stop selling their direct feeds.<sup>195</sup> Schneiderman took the view that direct feeds allowed subscribing HFTs to take advantage of the sub-second difference between the time when the provider firms released the information to subscribers and the time when news aggregators were able to receive and deliver that information to the broader public.<sup>196</sup> That time lag allowed HFTs to trade on the information ahead of, and at the expense of, other investors.<sup>197</sup>

As has recently been shown by Rogers et al.,<sup>198</sup> and Jackson and Mitts,<sup>199</sup> data providers were not the only source of early access to market-moving information filed by public companies: paying subscribers to the SEC's public dissemination system (PDS) feeds were also (although inadvertently<sup>200</sup>) allowed to early access company disclosures due to the time lag between the moment issuers uploaded their filings onto the system and the moment when information was actually posted to the EDGAR website and made publicly available.<sup>201</sup> Jackson and Mitts found that, on average, information reached subscribers to the PDS feeds 11 seconds earlier than it was publicly disseminated on the SEC's website: an advantage more than enough for HFTs to profitably trade upon early accessed information.<sup>202</sup>

After a *Wall Street Journal* article on the effects of the time lag associated with EDGAR dissemination was published,<sup>203</sup> the SEC tried to resolve the problem by imposing a delay on the premium subscriber feed.<sup>204</sup>

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195. Press Release, N.Y. St. Off. Att'y Gen., A.G. Schneiderman Announces Marketwired Agreement to End Sales of News Feeds to High-Frequency Traders (Mar. 19, 2014), <http://www.ag.ny.gov/press-release/ag-schneiderman-announces-marketwired-agreement-end-sales-news-feeds-high-frequency>.

196. *Id.*

197. *Id.*

198. See generally Jonathan L. Rogers et al., *Run EDGAR Run: SEC Dissemination in a High-Frequency World*, 55 J. ACCT. RES. 459 (2017) (describing the process through which SEC makes filing publicly available).

199. Robert J. Jackson, Jr. & Joshua R. Mitts, *How the SEC Helps Speedy Traders* 15–16 (Columbia Law Sch. Working Paper Series, No. 501, 2014), [http://papers.ssm.com/sol3/papers.cfm?abstract\\_id=2520105](http://papers.ssm.com/sol3/papers.cfm?abstract_id=2520105).

200. See Rogers et al., *supra* note 198, at 478 (“There is no expectation here that the PDS feed should always beat the EDGAR posting time: the service is not intended to provide a timing advantage; the PDS subscribers pay for access and happen in some cases to gain access before EDGAR posting.”).

201. *Id.* at 461 (finding that the process from upload to posting typically takes around 36 seconds).

202. *Id.* at 482–98 (showing that trades based upon early accessed filings generate profits that average around 28 bps over an 81-second period, which are regarded as economically significant for HFT firms).

203. Ryan Tracy & Scott Patterson, *Fast Traders Are Getting Data from SEC Seconds Early*, WALL ST. J. (Oct. 29, 2014, 2:18 PM), <http://www.wsj.com/articles/fast-traders-are-getting-data-from-sec-seconds-early-1414539997>.

204. See Robert J. Jackson et al., *Trading Against the Random Expiration of Private Information: A Natural experiment* 2, 2 n.2 (Columbia Bus. Sch., Research Paper No. 15-6, 2018), <https://ssrn.com/abstract=2544128>

(quoting Chairman White's December 2014 letter specifying that “the SEC would, by early 2015, ‘implement an enhancement to the system . . . to ensure that EDGAR filings [be made] available to the public on the SEC website before such filings [were] made available to PDS subscribers.”); see also Jackson & Mitts, *supra* note 199, at 14–15 (“[A] significant delay has been imposed on PDS clients’ receipt of SEC filings; in fact, a majority of PDS clients now receive filings *after* they are made available on the SEC website[,]” but also noting that “notwithstanding this change, a significant proportion of SEC filings are still made available to PDS subscribers well before they are made available to the public on the SEC’s website.”). An announcement on the SEC’s website advert that the EDGAR PDS New Subscriber Document was updated on February 23, 2015 “to reflect modifications to the EDGAR system to ensure that EDGAR filings are available to the public on the SEC website

## 2. *Exploiting Market Data Feeds and Co-Location*

Subscription to low-latency news feeds is not the only way in which HFTs are allowed to gain information advantages upon other investors.<sup>205</sup> According to Yadav, the rise of HFT has created a new form of insider trading—which she refers to in terms of “structural” insider trading—that is not based upon privileged access to material non-public corporate information, but which is in some way even more pervasive and dangerous for market integrity and stability.<sup>206</sup> The information advantage here is derived from a combination of three factors: co-location of HFTs’ servers next to those of exchanges; the ability of algorithms to minimize latency, process a huge amount of information, and send orders within infinitesimally short space of time;<sup>207</sup> and direct access to trading information provided by venues and further providers via subscription to market data feeds.<sup>208</sup>

Exchanges sell data feeds that deliver detailed trade information directly to the HFTs’ co-located facilities and offer a deeper view of market data and “insights about order flows on the exchanges and the best current quotes to buy and sell securities.”<sup>209</sup>

Private market data feeds grant a time advantage as compared to publicly provided market data, since subscribers access information earlier than non-paying investors.<sup>210</sup> Of course, exchanges’ proprietary data feeds are offered for subscription to any investor.<sup>211</sup> However, the truth is that only HFTs find themselves in a position of being positively able to take advantage of this by exploiting co-location and superior information-processing capacity in order to react immediately to new market information before it even reaches the wider market.<sup>212</sup>

In the U.S., this is possible as a consequence of the mandatory consolidated tape system. According to Reg NMS,<sup>213</sup> exchanges are required to offer investors the best price for the securities listed, and to display this price.<sup>214</sup> In

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before such filings are made available to the public dissemination system (PDS).” *Edgar Public Dissemination Service (PDS) System Contact Information*, U.S. SEC. & EXCH. COMM’N (Sept. 13, 2018), <https://www.sec.gov/oit/announcement/public-dissemination-service-system-contact.html>.

205. See Yadav III, *supra* note 179, at 976 (detailing combination of factors with which HFT can gain informational advantages).

206. *Id.*

207. See Andreas M. Fleckner, *Regulating Trading Practices*, in *THE OXFORD HANDBOOK OF FINANCIAL REGULATION 620* (Niamh Moloney et al. eds., 2015) (exploring the major themes regarding financial regulation and associated policy innovations).

208. See generally Yadav III, *supra* note 179, at 992–1002 (exploring the challenges for law and policy that arise from algorithmic trading).

209. *Id.* at 1013, 1000 (“Data included in direct feeds is often much richer than the information provided to the SIP . . . including information about various order types and their size. Exchanges might offer traders a menu of options, giving them a choice of subscription feeds that vary in the depth and detail that they provide.”).

210. See *id.* at 998–1013 (describing private market data feeds).

211. *Id.* at 999.

212. *Id.* at 998.

213. 17 C.F.R. § 242.600 (2010); 17 C.F.R. § 242.611 (2010).

214. This kind of latency arbitrage applies to the U.S. market only, where a public NBBO book is used. In Europe, the best execution obligation rests with the investment firm acting for its clients. See AUTH. FOR THE FIN. MKTS., *HIGH FREQUENCY TRADING: THE APPLICATION OF ADVANCED TRADING TECHNOLOGY IN THE EUROPEAN MARKETPLACE 16* (Nov. 2010) (discussing low latency trading strategies in the EU); Peter Gomber

order to enable investors to trade on different exchanges at the best displayed price in the NMS—which is known as the National Best Bid Offer (NBBO) for any security—each exchange is required to send continuously its best prices to a SIP, which consolidates prices from the various exchanges into the NBBO.<sup>215</sup>

However, the process of generating the NBBO introduces a minimal (but relevant for HFTs) time lag into the system, during which “HFT trades occur and prices are impacted. As such, by the time the SIP reacts with a price, its read of the market is already long out of date.”<sup>216</sup> Exchanges’ proprietary data feeds, which use faster infrastructures, enable HFTs to trade within the time lag necessary for consolidation by SIPs and to do this based on more up-to-date prices than those posted by the SIPs.<sup>217</sup>

This may sound counterintuitive since, in order to ensure that all investors have equal access to trading information, Reg NMS actually prohibits exchanges from submitting information to a direct feed any earlier than to a SIP.<sup>218</sup> However, within the tiny amount of time the SIP needs for consolidation, HFTs can autonomously aggregate data flowing from the inherently faster direct feeds, and synthetically anticipate the NBBO to trade upon.<sup>219</sup> Thus, HFTs are able to get consolidated market data substantially sooner than other market participants, and engage in practices such as front-running and dark pool arbitrage.<sup>220</sup>

Faster access to enriched trade data is not only associated with highly criticized front-running and further speed-based practices,<sup>221</sup> but also gives rise to many questions concerning the fundamental fairness of the markets and the creation of a two-tier system.<sup>222</sup>

Although no data consolidation system for post-trade transparency information throughout the EU is currently in place, and MiFID II does not mandate its establishment (although its development by private authorized providers is encouraged), it is worth noting that information inequalities benefiting those able to profit from early access to trade data characterizes European equity markets as well, where co-location and direct access to market

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et al., *High-Frequency Trading*, DEUTSCHE BÖRSE GRP. (2011), [http://deutsche-boerse.com/blob/2532148/050b9a4c5c9a2fbd73eca72fe9c0ff73/data/high-frequency-trading\\_en.pdf](http://deutsche-boerse.com/blob/2532148/050b9a4c5c9a2fbd73eca72fe9c0ff73/data/high-frequency-trading_en.pdf) (discussing the principals-based best execution regime as compared to the rules-based US approach).

215. See Shengwei Ding et al., *How Slow Is the NBBO? A Comparison with Direct Exchange Feeds*, 49 FIN. REV. 313, 314 (2014) (describing the two trading systems in the United States).

216. Yadav III, *supra* note 179, at 999.

217. *Id.*

218. Reg NMS Adopting Release, *supra* note 6, at 37567.

219. See generally McNamara, *supra* note 17, 110–14 (describing the process and components of the enriched data feed).

220. Adrian, *supra* note 91, at 267; see Ding et al., *supra* note 215, at 314–15 (explaining how not all market participants have access to information at the same time). But see Robert P. Bartlett, & Justin McCrary, *How Rigged Are Stock Markets? Evidence from Microsecond Timestamps* 8 (U.C. Berkeley Pub. L., Research Paper No. 2812123, 2017), <https://ssrn.com/abstract=2812123> (noting that direct feed arbitrage would be barely relevant to markets in 2015–2016).

221. Merritt B. Fox et al., *The New Stock Market: Sense and Nonsense*, 65 DUKE L.J. 191, 269–70 (2015) [hereinafter Fox II].

222. McNamara, *supra* note 17, at 114; Adrian, *supra* note 91, at 268–69.

information are equally typical for HFTs, in spite of the main role played by the equal access to information principle in the EU context.<sup>223</sup>

MiFID II regulates co-location with a view to the need to ensure “orderly and fair trading conditions.”<sup>224</sup> To this end, Article 48(12)(d) MiFID II requires trading venues to offer these services on a non-discriminatory, fair and transparent basis, and to ensure that fee structures do not create incentives for disorderly trading conditions or market abuse.<sup>225</sup> Co-location is considered to be offered in a fair and non-discriminatory way as long as, based on objective criteria, the same type of service is provided to all users under the same conditions and fees, without any requirement to purchase bundled services.<sup>226</sup> The risks of disorderly trading associated with fee structures that incentivize intensive trading are addressed by selectively allowing the application of price rebates to trades executed by a single market participant. Article 5 of Reg 2017/573 only allows trades executed in excess of a given threshold to benefit from lower fees, and therefore requires the application of non-rebated fees to trades executed below the threshold.<sup>227</sup>

The rules on co-location combine with those, set by Regulation (EU) No. 600/2014 of 15 May 2014 (MiFIR),<sup>228</sup> on pre- and post-trade transparency, requiring trading venues to make pre-trade and post-trade data available separately, and to offer trade data on a reasonable commercial basis. Specifically, Article 6 MiFIR calls on trading venues to make public “the price, volume and time of the transactions executed . . . as close to real-time as is technically possible,” while Article 13(1) requires them to make trade information “available to the public on a reasonable commercial basis and ensure non-discriminatory access to the information. Such information shall be made available free of charge 15 minutes after publication.”<sup>229</sup> Therefore, MiFID II and MiFIR do not require trading venues to avoid information asymmetry among investors that results from co-location and data feed services.

### *B. The Limited Reach of Insider Trading and Disclosure Rules for Preventing HFT-Related Informational Inequalities*

Along with co-location, subscription to private market data and news feeds grant HFTs faster access to information, which leads to a two-tiered system of

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223. See Armour et al., *supra* note 173, at 54–55 (discussing the regulation of HFT in Europe). See generally MiFID II, *supra* note 14, at 394, 433 (EU) (setting forth regulations for the financial services industry in Europe).

224. MiFID II, *supra* note 14, at 394, 359.

225. *Id.* at 394, 433.

226. See Commission Delegated Regulation (EU) 2017/573 of 6 June 2016 Supplementing Directive 2014/65/EU of the European Parliament and of the Council on Markets in Financial Instruments with regard to Regulatory Technical Standards on Requirements to Ensure Fair and Non-discriminatory Co-location Services and Fee Structures, 2017 O.J. (L 87) 145 (EU) (specifying these requirements with regard to regulatory technical standards on requirements to ensure fair and non-discriminatory co-location services and fee structures).

227. *Id.* at 145, 147.

228. Regulation (EU) No 600/2014 of the European Parliament and of the Council of 15 May 2014 on Markets in Financial Instruments and Amending Regulation (EU) No. 648/2012 O.J. (L 173) 84, 110 (EU).

229. *Id.* at 84, 110.

information dissemination.<sup>230</sup> The resulting information inequality seems to contrast with both the equal-timing requirement imposed by Reg FD for the release of corporate disclosures and the emerging wider area of information-dissemination law, which seeks to ensure “that an ever-increasing range of market-moving information is made available to all investors at the same exact time when first being shared with the public.”<sup>231</sup> The tendency of the courts to broaden the application of insider trading rules rooted in fiduciary duties to any case where information is improperly obtained also seems to be at odds with the structural information inequality existing among investors.

However, pinpointing the extent to which the U.S. legal framework may tolerate inequality in access to information is complex.<sup>232</sup> Most importantly, the inequalities described above<sup>233</sup> are not all comparable. It is necessary to draw a distinction depending upon whether the information advance relates to corporate information or to trading data.

The notion of “Insider Trading 2.0” as termed by the NYAG seems to be partially deceptive and, in any case, it is possibly appropriate only where referring to early access to corporate information via feeds sold by financial data providers.<sup>234</sup>

In fact, the 2014 agreement reached with two leading news wire providers to stop providing market-moving information to HFTs milliseconds before it was publicly disclosed did not make clear whether selling early access to corporate information violates the prohibition against insider trading.<sup>235</sup> However, although the NYAG has not prosecuted any participants in connection with the news wire arrangements, it has been contended that this practice falls within the scope of insider trading, by observing that:

The information provided under the advance access arrangements would have included, for example, earnings and tender offer announcements, that were often undoubtedly material. The information was nonpublic because news wires are often the vehicle through which public companies first disseminate corporate information. Indeed, what the preferred subscribers bargained for was precisely the receipt of the information before it was made available to the news wires’ general subscribers. The news wires certainly knew that the recipients of advance access would trade on the information. And the payments to the news wires constituted an undeniable benefit.<sup>236</sup>

Even though, with reference to the tipper’s liability, it is uncertain whether a breach of fiduciary duties is required—as is theorized under the classical

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230. McNamara, *supra* note 17, at 114; Adrian, *supra* note 92, at 268–69.

231. Haeberle & Henderson, *supra* note 178, at 1385.

232. *See* Adrian, *supra* note 92, at 268–69 (describing how the asymmetric access to information creates an unequal system).

233. Adrian, *supra* note 91, at 267; McNamara, *supra* note 17, at 114.

234. Bullard, *supra* note 171, at 237.

235. *See id.* at 237–40 (noting the NYAG implied that he would have sued the news wires for insider trading under New York’s Martin Act if they did not comply with his requests).

236. *Id.* at 240–41.

theory or the misappropriation theory—according to Bullard’s line of argumentation, it is apparent that this factor was also present in the news wire case discussed above since “[t]he news wire arrangements violated a *Chiarella/O’Hagan* duty to the corporate sources of the information not to provide advance access in violation of Regulation FD.”<sup>237</sup> Although Reg FD only applies to issuers, the argument goes, newswire providers still assume obligations in relation to the sale of their services, which easily qualify as fiduciary duties for the purposes of insider trading rules.<sup>238</sup> In fact, newswire providers usually assure their clients that the manner in which they disseminate their material information complies with Reg FD, which requires the simultaneous disclosure of such information to the public.<sup>239</sup> Since issuers use newswire providers to disseminate information according to Reg FD, newswire early access arrangements violate insider trading rules in that they breach their relationship of trust and confidence with the issuers.<sup>240</sup> Thus, “[u]nder the terms of Regulation FD, the news wires acted as agents of the issuers and therefore owed the issuers the fiduciary duties owed by an agent to its principal. Regulation FD requires issuers to make simultaneous public disclosure when the issuer ‘or [any] person acting on its behalf releases material, nonpublic information.’”<sup>241</sup>

Moreover, according to Rule 10b5-2,<sup>242</sup> a “duty of trust or confidence” exists where “the person communicating the material nonpublic information and the person to whom it is communicated have a history, pattern, or practice of sharing confidences, such that the recipient of the information knows or reasonably should know that the person communicating the material nonpublic information expects that the recipient will maintain its confidentiality[.]” Therefore, according to Bullard’s argumentation, the news wires are likely tippees because they know how their preferred subscribers use the information, and the news wires benefit by selling it.<sup>243</sup> The preferred subscribers are likely tippees because they know about the news wires’ violation of *Chiarella/O’Hagan* duties and trade anyway.<sup>244</sup> All elements of tipper and tippee insider trading liability are present.<sup>245</sup>

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237. *Id.* at 241.

238. *Id.* at 242.

239. *Id.*

240. *Id.* at 243 (“The prevention of selective disclosure is the primary responsibility that the news wires were hired to assume and promised to fulfill. Their selling of advance access breached their fiduciary duty to the issuers, which falls squarely within insiders’ duties under *Chiarella* and closely fits the classical theory of insider trading. Their profiting from providing selective disclosure created the benefit necessary for tippee liability.”). Consider, also, that Regulation FD admits selective disclosure to agents only where they owe a duty of trust or confidence to the issuer, or expressly agree to maintain the information disclosed in confidence (so long as it is publicly disclosed). *Id.* at 242–43.

241. *Id.* (citing Selective Disclosure and Insider Trading, Securities Act Release No. 7881, Exchange Act Release No. 43,154, Investment Company Act Release No. 24,599, 65 Fed. Reg. 51,716, 57,721 (Aug. 24, 2000)).

242. 17 C.F.R. § 240.10b5-2 (2018).

243. *Id.*

244. Bullard, *supra* note 171, at 244–45.

245. *Id.*

However, in spite of the interesting argument made by Mercer Bullard, it is not entirely clear if news wires are likely tippers. First, as a matter of fact, no action has been taken against news wires by the SEC and, as far as we are aware, the agreements signed by the NYAG constitute thus far the only initiative taken to prohibit early access arrangements.<sup>246</sup> Second, the fact that news feed providers act as agents of the corporation when they sell early access to information remains controversial, since, for example, it can be argued that news feeds consolidate news from a variety of different sources and do not necessarily act as agents of a specific corporation when they offer access at different speeds.<sup>247</sup>

Differently, there are no doubts that insider trading rules do not appear to apply to early access to trade data, and that the subscription to direct market data feeds does not violate Rule 10b-5, or Reg FD.<sup>248</sup> As data feeds are produced and sold by the exchanges, and obviously do not involve inside information, the classical theory based upon *Dirks* and *Chiarella*, which require a fiduciary responsibility towards shareholders in order to establish liability, does not apply.<sup>249</sup> Furthermore, the misappropriation theory is not consistent with early access to market data granted by data feeds, as under this theory insider trading liability only arises where the trader owes a duty of confidentiality to the source of the material, non-public information upon which the trade is based. In addition, courts require deception and not simply the breach of a fiduciary duty, in line with the anti-fraud goal of Section 10(b) of the Exchange Act.<sup>250</sup> Specifically, the Supreme Court has held that “an agent acts deceitfully when trading on the principal’s material, nonpublic information because he is holding himself out to the principal as a loyal agent while also acting in a disloyal fashion.”<sup>251</sup> Thus, there is no misappropriation-based insider liability where the recipient of the information declares that it is not loyal to the information source, or obtains the information source’s authorization to profit from the information received.<sup>252</sup> In view of this aspect, it is apparent that the misappropriation theory does not apply to our case, as data feed services are permitted by law, publicly advertised, and available for any investor willing to subscribe to.<sup>253</sup>

Furthermore, early access to not-yet-public market-moving information via direct data feeds does not violate Reg FD, which only applies “to disclosures

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246. *See id.* (describing tipper and tippee liability).

247. *Id.* at 254 (noting that regulators may consciously permit insider trading by acquiescing in advance access arrangements).

248. *Id.* at 242–44, 251 (describing news wires as agents with a fiduciary duty).

249. *See* Yadav III, *supra* note 179, at 1021–22 (discussing the doctrinal reach of *Dirks* and *Chiarella*).

250. *Id.*

251. Zachary J. Gubler, *A Unified Theory of Insider Trading Law*, 105 GEO. L.J. 1225, 1253 (2017). *See generally id.* at 1252–55 (describing the misappropriation theory).

252. *Id.* at 1253.

253. *Id.*; *see also* Nagy, *supra* note 169, 1333–34 (describing the Court’s application of misappropriation theory).

made in the name of the issuer or by ‘person[s] acting on [its] behalf.’<sup>254</sup> Hence, exchanges certainly fall beyond the scope of application of Reg FD.<sup>255</sup>

The non-applicability of insider trading law to market data feeds is consistent with the view that the practice of selling and buying early access to market data is widely regarded as legitimate.<sup>256</sup> Rule 603(a)(2) of Reg NMS only requires exchanges to distribute market data on terms that are not unreasonably discriminatory<sup>257</sup> and, according to the SEC, this language makes it clear that “Rule 603(a) prohibits an SRO or broker-dealer from transmitting data to a vendor or user any sooner than it transmits the data to a network processor.”<sup>258</sup> Therefore, as long as the signal sending the data to private feeds does not precede the signal sent to a SIP, it is permissible for core-data information to reach an HFT more quickly than the public recipients of the SIP.<sup>259</sup> Although such a line of argumentation is not undisputed,<sup>260</sup> the SEC explicitly acknowledged this outcome in 2010,<sup>261</sup> and did not take any action against exchanges that simultaneously submit data to the SIP and to private feeds, thus implicitly allowing subscribers to the service to access data much faster than others relying on consolidated data.<sup>262</sup>

C. *The Influence of HFT-Related Informational Inequalities on Market Efficiency: Lessening Informed Trading and the Incentives to Fundamental Analysis*

As has been shown above, insider trading law and disclosure rules set out in Reg FD seem not able to effectively tackle information inequality deriving from early access to information provided by private market data and news feeds.<sup>263</sup> Although news wires and market data feeds are available to all investors, the sale of these services *de facto* gives rise to information

254. Donna M. Nagy, *Beyond Dirks: Gratuitous Tipping and Insider Trading*, 42 J. CORP. L. 1, 38 (2016) (citing 17 C.F.R. § 243.101(c), (f)).

255. See Yadav III, *supra* note 179, at 1022 (discussing the reach of Rule 10b-5). It is worth noting that this outcome cannot be regarded as a direct consequence of the fiduciary duties-based approach to the prohibition on insider trading that is typically adopted by the U.S. courts. *Id.* In the EU too, where the principle of equal access to information is explicitly embraced by the MAR, the sale of faster access to proprietary feeds also falls outside the scope of insider trading rules, as these rules do not apply to exchanges, and market data do not fall within the definition of inside information under Article 7 MAR. MAR, *supra* note 143, at 24.

256. See McNamara, *supra* note 17, at 111 (questioning the legality of HFT-enabled transactions).

257. 17 C.F.R. § 242.603(a)(2).

258. Reg NMS Adopting Release, *supra* note 6, at 37567, 37569.

259. Fox II, *supra* note 221, at 270; see also Charles R. Korsmo, *High-Frequency Trading: A Regulatory Strategy*, 48 U. RICH. L. REV. 523, 564 (2014) (noting the availability of direct data feeds); John C. Coffee, Jr., *High Frequency Trading Reform: The Short Term and the Longer Term*, CLS BLUE SKY (July 21, 2014), <http://clsbluesky.law.columbia.edu/2014/07/21/high-frequencytrading-reform-the-short-term-and-the-longer-term/> (noting the advantages and disadvantages of high frequency trading).

260. See Fox II, *supra* note 221, at 271 (noting that a different interpretation of Rule 603(a) is also plausible, since sending the signal simultaneously to an HFT and SIP is unreasonably discriminatory when it is predictable some end users will receive it faster than others).

261. SEC Concept Release, *supra* note 4, at 3601.

262. As far as we are aware, the SEC only brought one action for breach of Rule 603(a)(2) in 2012: *In re NYSE*, Exchange Act Release No. 67857, 104 SEC Docket 2455 (Sept. 14, 2012), <https://www.sec.gov/litigation/admin/2012/34-67857.pdf> (contending that “NYSE often made its data available to customers sooner than NYSE sent data to the Network Processor.”).

263. See *supra* Part IV.B (discussing the reach of insider trading and disclosure rules).

asymmetries among investors, which benefits those, such as HFTs, that are actually in a position to profit from early access to information due to their superior capacity and speed in processing information and reacting to it.<sup>264</sup>

Information inequalities tolerated or admitted under the current insider trading and disclosure rules affect financial markets' efficiency in different ways, and challenge the theoretical framework underlying the ECMH.<sup>265</sup> Specifically, according to a quite broad array of empirical evidence,<sup>266</sup> there are reasons to believe that HFT's considerable weight in equity markets may negatively impact allocative efficiency by hampering the process by which prices tend to reflect fundamental values.<sup>267</sup>

More precisely, HFT negatively impacts this process by impairing the role played in this respect by informed fundamental traders and financial analysts.<sup>268</sup> As Gilson and Kraakman have explained,<sup>269</sup> trading by professional traders leads market prices to incorporate fundamental information that is publicly available. Due to their analysis of public information, informed traders are able to detect differences between a security's market price and its estimated fundamental value, and their trades, which seek to earn profits from their (legitimate) information advantage, eventually result in price adjustments until they become aligned with the estimated fundamental values.<sup>270</sup>

HFT seems able to impair the market efficiency mechanism designed by Gilson and Kraakman.<sup>271</sup> Contrary to what one may expect,<sup>272</sup> empirical evidence mentioned in Part II.B.2 shows that HFT can force informed traders to adapt their trading and reduce their incentives to perform their role in filling the gap between market prices and fundamental values.<sup>273</sup> In fact, these incentives are strictly related to the possibility of profiting from the first-mover advantage gained through investing in information research and analysis. However, HFTs are capable of eroding this crucial advantage through the order-anticipation strategies they successfully deploy thanks to faster access to market data feeds, their ability to detect how professional traders are going to transact and higher

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264. *Id.*

265. *See generally* Eugene F. Fama, *Efficient Capital Markets: A Review of Theory and Empirical Work*, 25 J. FIN. 383 (1970) (explaining theoretical literature on efficient capital markets); Gilson & Kraakman, *supra* note 151, at 569–72 (1984) (explaining the interactions between capital market mechanisms and the information market); Zohar Goshen & Gideon Parchomovsky, *The Essential Role of Securities Regulation*, 55 DUKE L.J. 711, 732–55 (2006) (explaining how securities regulations help create a competitive market).

266. *See supra* Part II.B.2 (providing data on HFT's effect of the market).

267. *See* Yadav I, *supra* note 16, at 1662–63 (noting that the trading behavior of HFT traders can induce traditional informed traders not to invest in obtaining meaningful information as before); *see also* Korsmo, *supra* note 259, at 572–73 (analyzing HFT's effects on efficient pricing).

268. Yadav I, *supra* note 16, at 1652–55.

269. Gilson & Kraakman, *supra* note 150, at 569–72; *see generally* Merritt B. Fox et al., *Informed Trading and Its Regulation*, 43 J. CORP. L. 817 (2018) [hereinafter Fox III] (explaining how public information could affect market prices).

270. Gilson & Kraakman, *supra* note 150, at 569–72.

271. Yadav I, *supra* note 16, at 1659.

272. As markets are self-correcting, it would appear that price distortions caused by HFTs create arbitrage opportunities for other traders, for whom investing in information research should be profitable in order to take advantage of that arbitrage opportunity.

273. *See supra* Part II.B.2 (providing data on how informed traders adapt).

speed in order generation.<sup>274</sup> While informed investors are engaged in analyzing fundamental information, HFTs are capable of extracting profits by anticipating institutional investors' order flows.<sup>275</sup>

Thus, informed traders are incentivized to adapt their investment strategies in order to protect their trading from being instantly tracked by flash traders, and to prevent these from very quickly eliminating their information advantage.<sup>276</sup> First, informed traders may divert orders towards ATSs and dark pools, although it remains questionable whether dark pools and ATSs are actually a safer place for informed traders.<sup>277</sup> Second, informed traders may decide to trade less often, and in particular only when “they have ‘big’ news that is likely to generate a significant profit, justifying transaction costs and losses to HFT traders.”<sup>278</sup>

Such strategies on the part of informed traders can impair the efficiency of regulated markets as a consequence of growing levels of undisplayed liquidity, and a reduced signaling value of prices on regulated markets, or, at the very least, slow down the process by which fundamental information is incorporated into prices.<sup>279</sup> Should the percentage of orders of long term investors executed in non-displayed trading venues reach a sufficiently high level, the corresponding volume of “dark” liquidity may negatively impact public price discovery on displayed marketplaces.<sup>280</sup> A redirection of order flows towards non-displayed venues may in fact reflect the fact that exchanges are executing an increasing number of orders that are primarily attributable to HFTs.<sup>281</sup>

These predictions are consistent with analytical findings showing that the presence of HFTs in the market can influence the process of collecting

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274. Yadav I, *supra* note 16, at 1659–60 (noting that “[s]peed and anticipatory intelligence enable HFT traders to purchase substitute securities and to trade them before a professional trader is able to complete her transaction. For the HFT, this move captures the informed upside and reduces further gains that might accrue to professionals.”).

275. Graham Partington et al., *Is High Frequency Trading Good for Capital Markets?*, COLUM. L. SCH. BLUE SKY BLOG (Dec. 15, 2015), <http://clsbluesky.law.columbia.edu/2015/12/15/is-high-frequency-trading-good-for-capital-markets> (stressing that “HFTs are skimming cream off the top of an institutional investor’s fundamental analysis.”).

276. See Stiglitz, *supra* note 77, at 8 (noting that flash traders can exploit information from the informed traders, rendering the effort for obtaining the information useless); see also Yadav I, *supra* note 16, at 1662 (citing Tong, *supra* note 48, at 3–4); see also Partington et al., *supra* note 275 (stating “[i]t is therefore not surprising that some institutional investors have been crying foul and moving transactions off major security exchanges due to their concerns about HFT.”).

277. *People v. Barclays Capital Inc.*, 1 N.Y.S.3d 910 (N.Y. Sup. Ct. 2015) (deciding civil fraud charges against Barclay over its private stock trading platform, contending that it favored high-frequency traders over other investors). See William Alden, *Barclays Faces New York Lawsuit Over Dark Pool and High-Frequency Trading*, N.Y. TIMES (June 25, 2014, 3:28 PM) <https://dealbook.nytimes.com/2014/06/25/n-y-attorney-general-to-accuse-barclays-of-fraud-over-dark-pools> (discussing the Barclay lawsuit); see also Kristin N. Johnson, *Regulating Innovation: High Frequency Trading in Dark Pools*, 42 J. CORP. L. 833, 866–80 (2017) (stating “[a]s the market share of dark pool transactions have increased, predators who employed opportunistic trading strategies on lit exchanges, replicate their strategies in dark pools”); Adrian, *supra* note 91, at 263–65 (illustrating that “pinging” and order cancellation techniques render HFTs capable of front-running whilst also slowing traders in dark pools); MiFID II, *supra* note 14, at 359 (stating “[h]igh-frequency trading may also, because of the information advantage provided to high-frequency traders, prompt investors to choose to execute trades in venues where they can avoid interaction with high-frequency traders”).

278. See Yadav I, *supra* note 16, at 1662 (explaining when its beneficial for informed traders to trade).

279. *Id.* at 1662–63.

280. SEC Concept Release, *supra* note 4, at 3613.

281. *Id.*

information by, and the trading decisions of, fundamental traders.<sup>282</sup> Namely, the impact of HFT on fundamental traders' decisions depends on the information HFTs are able to observe.<sup>283</sup> As Draus has observed, both price informativeness and efficiency decrease when HFTs have information on past trading activity of fundamental traders in order to predict their coming trades.<sup>284</sup> In fact, if HFTs are able to observe past trading activity, producing fundamental information becomes less profitable and fundamental traders reduce their trading intensity.<sup>285</sup> Therefore, the argument goes, "the reduced trading intensity lowers the portion of produced information reflected in prices. This effect combined with less information production lowers also the extent to which prices reflect the asset value."<sup>286</sup> Given that information produced by fundamental traders will be incorporated into market prices to a lower degree than in the benchmark case of trading without HFTs, which will ultimately result in less informative prices, market efficiency will be reduced in the longer run.<sup>287</sup>

It is further worth highlighting that HFT can influence market efficiency also in a different way, since it is structurally inadequate for contributing to long-term price discovery.<sup>288</sup> In fact, high-frequency trades are typically not, or are at most marginally, based upon information that is publicly available concerning securities and their issuers, and a fundamental analysis of that information.<sup>289</sup> Instead, orders are forwarded to the appropriate trading venue according to an algorithm that, based on pre-programmed decision-making rules concerning timing, price, volume, etc., automatically converts inputs, mainly comprised of market data concerning intra-day price dynamics, into orders.<sup>290</sup> Since computerized orders are not particularly sensitive to firm-specific information, HFT questions the theoretical framework of the informational efficiency of financial markets, which underlies the current regime of issuers' public disclosures.<sup>291</sup> In fact, HFTs do not have a real interest in the securities they trade, nor in their issuers, but mainly look at real-time market trends, information concerning transactions occurring in each market on which they trade, and order updates posted by other market participants, in order to predictively anticipate the market.<sup>292</sup>

Some algorithms do collect and weight information flowing from disclosure dissemination systems as well as other sources, such as news and social media.<sup>293</sup> However, also in this case HFTs are not comparable with

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282. Draus *supra* note 82, at 6–19.

283. *Id.*

284. *Id.* at 3.

285. *Id.* at 3–4.

286. *Id.*

287. Yadav I, *supra* note 16, at 1658–65.

288. Frank Holmes, *The New Challenges of Price Discovery*, BUS. INSIDER (Sept. 8, 2014) <https://www.businessinsider.com/the-new-challenges-of-price-discovery-2014-9>.

289. Yadav I, *supra* note 16, at 1645–46.

290. *Id.* at 1620.

291. See Gilson & Kraakman, *supra* note 150, at 549 ("Of all recent developments in financial economics the efficient capital market hypothesis ('EMCH') has achieved the wildest acceptance by the legal culture.")

292. See Fox I, *supra* note 39, at 488 (discussing the functions of HFTs).

293. See Yadav I, *supra* note 16, at 1625 ("Designed to trade in micro and milliseconds, HFT algorithms routinely receive data from newsfeeds, social media, exchanges, and regulatory agencies.")

“traditional” informed professional investors such as hedge funds or actively managed mutual and pension funds.<sup>294</sup> While traditional investors trade on the basis of the estimated fundamental value of securities they derive from an analysis of public information, HFTs do not directly dig into information, but only carry out mechanical and quantitative standardized checks of items of information that relate to securities.<sup>295</sup> In contrast to informed traders,<sup>296</sup> due to ultra-low latency, HFTs do not make any special efforts to check the accuracy of information processed. For example, algorithms may be programmed to consider how many times a piece of information concerning an issuer is repeated throughout the various sources they access.<sup>297</sup>

Therefore, automated software-based orders cannot provide any active informative contribution as regards the fundamentals of securities.<sup>298</sup> Whilst programmed to react quickly to immediate news, it remains doubtful whether algorithms are also modeled to absorb information concerning longer-term fundamentals, since HFTs’ trades are clearly focused on the very short term.<sup>299</sup>

Moreover, in some cases, the automated scanning of information flows operated by HFT algorithms can significantly distort market prices by reacting to false pieces of news or incorrectly interpreting patterns of words.<sup>300</sup> For instance, in April 2013, HFT algorithms immediately reacted to a tweet reporting that explosions had occurred at the White House and that President Obama had been injured.<sup>301</sup> Within a few minutes, their reaction caused the Dow Jones Industrial Average and the S&P 500 to fall significantly.<sup>302</sup> In fact, as professor Yadav has argued,

models generate overly stylized, simplified representations of otherwise messy economic relationships. Put more simply, models can be unreliable and generate bad outcomes . . . Algorithms may over-value some data, under-emphasize it in other cases, make mistakes, and fail to check its truthfulness. This danger is especially

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294. *Id.*

295. *See id.* at 1625 (mentioning that “HFT algorithms generally scan through incoming news and react rapidly to certain evocative words like ‘unemployment,’ ‘recession,’ ‘IPO’ etc.”); Prewitt *supra* note 42, at 143–44 (noting that “HFTs do not contribute new information to security prices, unlike long-term investors who carefully analyze the underlying value of assets.”).

296. *See* Gilson & Kraakman, *supra* note 150, at 564 (“[T]raders may attempt to ascertain the accuracy of information that they have obtained from others. Most trading facts are acquired second-hand from sources of widely varying credibility. Traders frequently learn the surface content of alleged facts but remain uncertain about their accuracy. The third response to uncertainty is the effort to resolve these doubts, either through study or the acquisition of new facts.”).

297. *See* Yadav I, *supra* note 16, at 1625 (explaining the information that algorithms use when making trades).

298. *See* Zhang, *supra* note 41, at 2–3 (discussing how “high-frequency trading is negatively related to the markets ability to incorporate information about firm fundamentals into asset prices.”).

299. *See* Yadav I, *supra* note 16, at 1657 (noting that HFT traders have the most incentive in programming algorithms for short-term trading models as it is expensive and difficult to fully comprehend information about long-term fundamentals).

300. *Id.* at 1625.

301. *Id.*

302. *Id.* at 1649 (noting that “[m]odel risks are certainly not new. Moreover, the alternative, relying on human brains and intuition, is also far from perfect and is certain to leave deep gaps in data collection and analysis. The challenge for markets lies not in the bare fact of model risks but in its extent.”).

live in the case of high speed, high volume algorithms designed to respond in milliseconds to incoming information.<sup>303</sup>

As a consequence, “[i]nformation losses through model errors create gaps in knowledge for investors.”<sup>304</sup> This is in line with evidence provided by empirical studies illustrated above,<sup>305</sup> which support the view that HFT negatively impacts market prices’ capacity to reflect fundamental values, along with their information and signaling value.

## V. LIMITING THE NEGATIVE EFFECTS OF HFT ON (LONG-TERM) MARKET EFFICIENCY: A CONCEPTUAL FRAMEWORK

Having illustrated how HFT interacts with long-term market efficiency, this Part will develop an analytical framework for regulatory strategies that could be taken into consideration in order to rein in these negative effects.

### A. *Constraining the Exploitation of HFTs’ Informational Advantage*

Having shown that the impact of HFT on price informativeness relies on the ability of HFTs to access relevant data earlier than slower traders, especially trade data,<sup>306</sup> it is necessary to consider the policy options potentially available in order to minimize this informational advantage.<sup>307</sup>

#### 1. *Banning Early Access to Data Feeds*

Apart from the enhancement of the SIP infrastructures in order to reduce the speed gap compared to direct data feeds, potential measures aimed at restoring the effectiveness of information equality among investors involve, first, a prohibition on the sale of early access to data feeds.<sup>308</sup>

This would only require the SEC to change its interpretation of Rule 603(a)(2) of Reg NMS, which prohibits exchanges’ “unreasonably discriminatory” distribution of market data.<sup>309</sup> As mentioned above, according to the SEC, “distributed data [can] not be made available on a more timely basis [to private clients] than core data is made available to a Network processor [the SIP].”<sup>310</sup> It would be sufficient to adopt a different interpretation, according to which the simultaneous transmission of the signal to private data feeds and to the SIP arguably results in an “unreasonably discriminatory” distribution of core

303. *Id.* at 1647–48.

304. *Id.* at 1658.

305. *See supra* Part II.B.2 (providing empirical studies of how HFTs negatively impact the market).

306. *See* Adrian, *supra* note 91, at 261–62 (explaining how HFTs affect prices because of early access to data).

307. *See* Frank Pasquale, *Law’s Acceleration of Finance: Redefining the Problem of High-Frequency Trading*, 36 CARDOZO L. REV. 2085, 2093 (2015) (“HFT strategy depends entirely on information advantage—knowing something (or algorithmically decoding some signal) before everyone else does.”).

308. *See* Adrian, *supra* note 91, at 277 (“The only real solution to the problem is for the SEC to either spend the substantial amount of money it would take to eliminate the sizeable gap between the SIP and direct feeds, or to prohibit exchanges from selling raw data entirely.”); White I, *supra* note 14, Part III.

309. 17 C.F.R. 242.603(a)(2).

310. NMS Adopting Release, *supra* note 6, at 37,567.

data to end users, given that it is predictable that HFTs will consistently receive it faster than others.<sup>311</sup> Alternatively, Rule 603(a)(2) could be modified in order to make it clear that the simultaneous transmission of the signal to private data feeds and to the SIP is prohibited.<sup>312</sup> Preventing exchanges from selling early access to trade data would restrain electronic front-running and low-latency arbitrage, since HFTs would lose the ability to preview order flows and calculate the NBBO in advance of the SIP's consolidation.<sup>313</sup>

Nevertheless, the effectiveness of such measures has been disputed on the grounds that a ban on data feeds, or restrictions to their use, would have an equal impact on any investor. As has been argued, “stipulating, for example, that [direct feeds] be standardized across exchanges and include less information than is currently on offer[,]” would theoretically cause HFTs to see some losses, “because their data feeds are less in-depth and perhaps not sufficiently informative to provide a fulsome idea of order flows. But everyone else will see losses as well. Structural outsiders will see thinner information and be forced to privately invest in overcoming deficiencies.”<sup>314</sup>

However, this argument should not be overstated. A counter-argument can be made, similar to that made by the SEC with respect to its proposed ban on flash orders, according to which, although “all those who take a market's data feed will receive the flashed order information, only market participants with pre-programmed systems capable of responding very rapidly will have a realistic opportunity, as a practical matter, to respond to a flashed order.”<sup>315</sup> Therefore, possible losses for low-speed traders arising from the ban on or restriction of the sale of early access to market data feeds would appear to be limited.<sup>316</sup>

## 2. *Slowing Down HFT Through Speed Bumps or Frequent Batch Auctions*

In order to smooth over information inequalities, alternative measures aimed at reducing HFTs' speed advantage by slowing down their trading may also be considered. The SEC may introduce delays into order submission or execution, considering that “[w]ith some micro- or milliseconds worth of a delay in place, orders from institutional traders might not be systematically usurped in part by the innately faster trader.”<sup>317</sup> Speed bumps have recently been implemented by IEX, a U.S. trading venue registered as an exchange since 2016.<sup>318</sup> In line with its philosophy,<sup>319</sup> IEX abstains from selling different tiers

311. See *supra* Part IV.B (noting the limited reach of insider trading to HFTs).

312. See Letter from Edward E. Kaufman, U.S. Senator, to Mary L. Schapiro, U.S. Sec. & Exch. Comm'n (Nov. 20, 2009) (on file with the University of Delaware Library) (asking for the commission's time table for addressing concerns about the market issues).

313. Fox II, *supra* note 221, at 269.

314. Yadav III, *supra* note 179, at 1027.

315. See Elimination of Flash Order Exception from Rule 602 of Regulation NMS, 74 Fed. Reg. 48,632, 48,634 (proposed Sept. 23, 2009) (to be codified at 17 C.F.R. pt. 242) (highlighting that “[i]n other words, only those who have invested in sophisticated trading systems are able to effectively access flash orders.”).

316. *Id.*

317. Yadav III, *supra* note 179, at 1028.

318. LEWIS, *supra* note 1, at 177–79.

319. *IEX Launches Free Web API*, IEX (Feb. 22, 2017), <https://iextrading.com/about/press/2017/01/> (“IEX is the Investors Exchange: a fair, simple, and transparent stock exchange dedicated to investor and issuer

of connectivity or even to offer co-location but also, in order to eliminate HFTs' speed advantage, it has laid 32 miles of fiber optic cable which work as a speed bump, as orders have to travel the increased distance.<sup>320</sup> The delay created corresponds to roughly 350 microseconds, during which IEX processes and routes trades to any exchange in the country before HFTs are able to see the order flow and anticipate slow traders.<sup>321</sup>

Mandating speed bumps does not require major regulatory changes.<sup>322</sup> When assessing the application of IEX to register as an exchange, the SEC found IEX's speed bump to be compliant with Reg NMS. On that occasion, the SEC updated its interpretation of the meaning of the term "immediate" used in Rule 600(b)(3),<sup>323</sup> according to which "[s]olely in the context of determining whether a trading center maintains an 'automated quotation' for purposes of Rule 611 of Regulation NMS, the Commission does not interpret the term 'immediate' used in Rule 600(b)(3) by itself to prohibit a trading center from implementing an intentional access delay that is *de minimis*—i.e., a delay so short as to not frustrate the purposes of Rule 611 by impairing fair and efficient access to an exchange's quotations."<sup>324</sup>

The speed advantage may further be eliminated, or reduced, by acting on the current structure of continuous trading, according to which execution priority depends on the time of order arrival within a continuous sequence.<sup>325</sup> Budish, Cramton, and Shim suggested replacing the continuous-trading regime with a discrete-time trading regime based on frequent batch auctions.<sup>326</sup> Under this model, the trading day is divided into extremely frequent but discrete time intervals (say one millisecond), and "at the end of each interval, all outstanding orders are processed in batch, using a uniform-price auction, as opposed to the serial processing that occurs in the continuous market."<sup>327</sup> Batched auctions should eliminate HFTs' speed advantage, since orders are not displayed during the order submission stage and, more generally, in a continuous-time market, an

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protection. Built on the belief that every investor is entitled to the same right to trade on equal terms on every single trade, IEX is on a mission to level the playing field by eliminating unfair advantages from the markets.").

320. LEWIS, *supra* note 1, at 177–79.

321. Adrian, *supra* note 91, at 272; Matt Levin, *Speed Bumps Are the Hot New Thing for Exchanges*, BLOOMBERG OP. (Aug. 31, 2016), <https://www.bloomberg.com/view/articles/2016-08-31/speed-bumps-are-the-hot-new-thing-for-exchanges> ("If you give IEX an order to buy 5,000 shares, and there are 500 shares available on IEX at \$20.00 and 4,500 available elsewhere at \$20.00, IEX will sell you the 500 shares at \$20.00 and route the rest of your order to the other exchanges. But! The people who sold you the 500 shares on IEX *won't find out for 350 microseconds*, so they won't be able to race ahead of you to the other exchanges to jack up the price.").

322. Commission Interpretation Regarding Automated Quotations Under Regulation NMS, 81 Fed. Reg. 40,785, 40,792 (June 23, 2016) [hereinafter Commission Interpretation] (to be codified at 17 C.F.R. pt. 241).

323. 17 C.F.R. 242.600(b)(3) (2011).

324. Commission Interpretation, *supra* note 322, at 40,792.

325. See Eric Budish, Peter Cramton & John Shim, *The High-Frequency Trading Arms Race: Frequent Batch Auctions as a Market Design Response*, 130 Q.J. ECON. 1547, 1549 (2015) (describing an additional manner of reducing the speed advantage).

326. *Id.*

327. *Id.*

infinitesimal speed advantage is enough to always win the race, while in a discrete-time market the same speed advantage is less valuable.<sup>328</sup>

Unlike speed bumps, batch auctions pose major legal questions concerning their compatibility with Reg NMS.<sup>329</sup> First, the interaction between batch auctions and broker-dealers' duty of "best execution" set out by Rule 611(a)(1), which promotes intermarket price protection of orders by restricting the execution of trades on one venue at prices that are lower than those displayed at another venue, would appear to be problematic.<sup>330</sup> Under a batch auction system, where prices are determined only at the end of a batch interval, meaning that a broker-dealer cannot know in advance which venue will yield the best price,<sup>331</sup> it would not be possible to apply the best execution Rule since broker-dealers cannot be sure that they are submitting an order to the venue with the best price at any given point in time.

Second, it is doubtful whether batch auctions comply with Rule 600(b)(3), as they delay order execution.<sup>332</sup> According to the SEC's interpretation of this Rule, a delay in order execution is admissible as long as it is so short as not to frustrate the purposes of Rule 611.<sup>333</sup> Considering the SEC's decision concerning the registration of IEX as an exchange, batch auctions should be deemed to be acceptable unless they introduce a delay longer than that imposed by IEX's speed bump.<sup>334</sup> However, the implementation of batch auctions appears to be quite complex, and would require radical changes to the current equity markets regime.<sup>335</sup> In fact, within a multi-exchange context, coordination among exchanges seems to be necessary in order to eliminate HFTs' speed time advantage.<sup>336</sup> Unless batch auctions were mandated throughout the NMS, competition between exchanges that adopt batch auctions and those embracing continuous trading would clearly be distorted,<sup>337</sup> and HFTs would remain able

328. Eric Budish, Peter Cramton & John Shim, *Implementation Details for Frequent Batch Auctions: Slowing Down Markets to the Blink of an Eye*, 104 AM. ECON. REV. 418, 418 (2015) ("[M]odifying the market design from a serial process to a batch process transforms the nature of competition—from competition on speed to competition on price. Rather than competing to be the first message processed, traders compete to be the most attractive quote."); see also Mahoney & Rauterberg, *supra* note 45, at 44–45 (discussing batched auctions and speed bumps); Michael Morelli, *Implementing High Frequency Trading Regulation: A Critical Analysis of Current Reforms*, 6 MICH. BUS. & ENTREPRENEURIAL L. REV. 201, 205 (2017) ("[B]atch auctions theoretically incentivize HFT firms to make more trades based on information related to a security's fundamentals and dissuade them from engaging in other aggressive strategies that add little to price discovery.").

329. Morelli, *supra* note 328, at 206.

330. Memorandum from the SEC Div. of Trading & Mkt. to the SEC Mkt. Structure Advisory Comm. 18 (Apr. 30, 2015), <https://www.sec.gov/spotlight/emsac/memo-rule-611-regulation-nms.pdf>.

331. Morelli, *supra* note 328, at 206.

332. *Id.*

333. Mahoney & Rauterberg, *supra* note 45, at 46.

334. *Id.* ("The batch auction would be permissible only if the entrepreneur could persuade the SEC that the interval between auctions is *de minimis*.")

335. Sviatoslav Rosov, *Are Frequent Batch Auctions a Solution to HFT Latency Arbitrage?*, MKT. INTEGRITY INSIGHTS (Nov. 10, 2014), <https://blogs.cfainstitute.org/marketintegrity/2014/11/10/are-frequent-batch-auctions-a-solution-to-hft-latency-arbitrage/> ("To get around the asynchronicity of price discovery between exchanges, all exchanges would have to become frequent batch auctions and have the auctions perfectly synchronised for the discrete-time auction model to work, in its strictest interpretation.").

336. *Id.*

337. *Id.* ("[T]he problem for the batch auction model is that pre-trade transparent continuous-auction exchanges would be constantly updating prices in real time, providing true price discovery, which could

to exploit some latency arbitrage, as would be the case, for instance, for trading derivatives and ETFs, were these markets not to be coordinated as well.<sup>338</sup>

*B. Fostering Long-Term Market Efficiency by Reducing Information-Research Costs Borne by Fundamental Informed Traders*

As has been shown above, there are different ways in which the information inequalities currently existing between HFTs and slow traders can be reduced.<sup>339</sup> To this end, a prohibition on the sale of private trade data feeds seems to be unnecessary. First, equal access to market data could be restored if the SEC were to adopt the interpretation of Rule 603(a)(2) according to which distributed data cannot be made available to private clients before core data is made available to a network processor.<sup>340</sup> Secondly, speed advantages could be significantly limited, if not eliminated, if speed bumps were mandated or if the current continuous-trading system were replaced with an alternative market structure, e.g. a discrete-time trading regime based on frequent batch auctions.<sup>341</sup> While not affecting private data feeds, these measures would largely prevent HFTs from micro-front-running other investors, which would bear a limited risk of transacting on stale information.<sup>342</sup> Hence, “[w]hile HFT traders can still receive direct feeds and be co-located, the insights received through early sight of this information do not have to result in systematic gains for the HFT traders.”<sup>343</sup>

Although the regulatory approaches illustrated above could alleviate the impact of a two-tiered access to trading data, they still remain problematic and raise questions that are as yet unresolved, and call for further empirical study.<sup>344</sup>

First, even if the conditions under which private data feeds could be sold were tightened up or if measures were adopted to slow down HFTs’ trades, it seems that this would be unlikely to be capable of fully leveling the playing field among investors.<sup>345</sup> As noted above, although early access to market data feeds seems to play a major role,<sup>346</sup> HFTs could still obtain faster access to market-moving information by subscribing to newswire services that grant an early insight into corporate information from many issuers before providers release them to the broader public.<sup>347</sup> Despite the charges brought against international traders who benefited from insider information hacked from business newswires, and despite recognizing that newswire services constitute a repository of material non-public information until the information received is

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complicate the discrete-time batch auction process.”). *But see* Mahoney & Rauterberg, *supra* note 45, at 46–48 (discussing eliminating the NMS).

338. Morelli, *supra* note 328, at 206.

339. Yadav III, *supra* note 179, at 1026.

340. Mahoney, *supra* note 45, at 42.

341. *Id.* at 45 (discussing a proposal to “replace continuous time trading with discrete but frequently repeated batched auctions, say every one millisecond”).

342. Yadav III, *supra* note 179, at 1028.

343. *Id.*

344. *Id.* at 1032.

345. *Id.* at 1029.

346. *See supra* notes 299–301 (explaining the role early access plays in data market feeds).

347. Tracy & Patterson, *supra* note 203.

delivered to the public,<sup>348</sup> the SEC has not brought any action against newswire providers on account of the faster access to information that is granted to paying subscribers, and seems therefore to tolerate this type of information inequality.<sup>349</sup> Additionally, there is a long list of entities other than public firms that generate market-moving information which is selectively released to high-speed traders willing to pay for earlier access.<sup>350</sup>

Second, both banning early access to market data feeds and mandating speed bumps could discourage HFT and negatively impact market quality, given that marketplaces are increasingly more dependent on the liquidity provided by HFTs.<sup>351</sup> These measures may also weaken the positive effects of HFTs on short-term price discovery, which have been documented by a number of empirical findings.<sup>352</sup>

Third, the leveling of information inequalities resulting from tiered access to trading data may not be enough to prevent the potentially distorting effects of HFT on market efficiency. Although further analysis is certainly needed, a number of empirical studies show that HFT reduces the ability of prices to incorporate long-term fundamental information, which negatively impacts allocative market efficiency.<sup>353</sup> Banning the sale of faster access to market data, or slowing down HFTs' trades, are remedies that seem to be incapable of avoiding the risk (i.e. "model risk") that algorithmic programming may hinder the process by which information is incorporated into prices due to gaps in analysis, making incorrect assumptions, and adopting sub-optimal preferences in interpreting information.<sup>354</sup>

Fourth, it is indeed the case that preventing early access to trading information or reducing the impact of structural information advantages can reduce HFTs' free-riding on research deployed by information-investors, and therefore minimize the risk that HFT might disincentivize information research by institutional investors, which is crucial to price discovery and market efficiency.<sup>355</sup> However, these measures do not definitely eliminate HFTs' free-riding given that, in any case, some market participants with more sophisticated computer infrastructure will still be able to faster access data transmission after

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348. See Press Release, Sec. & Exch. Comm'n, SEC Charges 32 Defendants in Scheme to Trade on Hacked News Releases (Aug. 11, 2015), <https://www.sec.gov/news/pressrelease/2015-163.html>.

349. Bullard, *supra* note 171, at 240 ("Nor has the Commission brought any enforcement actions that are related to the news wire arrangements.")

350. See Kevin S. Haerberle & M. Todd Henderson, *Making a Market for Corporate Disclosure*, 35 YALE J. ON REG. 383, 403–04 (2018) (discussing entities that generate market-moving information).

351. Peter J. Henning, *Market Changes May Prompt New Definition of Insider Trading*, N.Y. TIMES (Nov. 4, 2015), <https://www.nytimes.com/2015/11/05/business/dealbook/market-changes-may-prompt-new-definition-of-insider-trading.html>.

352. See *supra* Part II.B.2 (discussing the empirical findings).

353. See *supra* Part IV.C (discussing these empirical studies).

354. See Yadav I, *supra* note 16, at 1644–52 (highlighting that "[a]lgorithms may over-value some data, under-emphasize it in other cases, make mistakes, and fail to check its truthfulness. This danger is especially live in the case of high speed, high volume algorithms designed to respond in milliseconds to incoming information.")

355. Yadav III, *supra* note 179, at 1028.

distribution of the data to a common source.<sup>356</sup> The securing of this kind of advantage results solely from a participant's choice to dedicate resources to its data processing capabilities, which cannot obviously be prohibited.<sup>357</sup> It is therefore unavoidable that HFTs will be better able to process information much more quickly than slow-traders, particularly retail investors.<sup>358</sup>

In summary, regulatory approaches that seek to limit HFTs' speed advantage, on the one hand, may harm short-run price discovery by discouraging HFTs' trading activity.<sup>359</sup> On the other hand, they also seem to be incapable of preventing HFT's potential negative impact on allocative market efficiency, since HFTs only consider a very short time horizon and do not carry out fundamental analysis.<sup>360</sup>

Consequently, regardless of the measures adopted in order to reduce the speed advantage of HFTs, it seems that lawmakers and regulators should consider taking action to favor allocative efficiency within HFT dominated capital markets. In particular, given the essential role played by fundamental informed traders in fostering allocative market efficiency,<sup>361</sup> regulatory intervention would appear to be appropriate in order to incentivize these market participants to enter markets where they face costly pressures to compete with HFT.<sup>362</sup> Regulators may therefore consider adopting measures with a view to reducing information search costs borne by fundamental informed traders and, specifically, providing them with a more frequent and cheaper access to the information they need in order to carry out fundamental analysis of investee companies.

To this end, two different—and to some extent opposing—strategies may be taken into consideration. The first strategy relies on selective disclosure of material non-public information, as allowed under Reg FD, as an incentive for informed traders to perform fundamental analysis.<sup>363</sup> However, given the potentially disincentivizing effect resulting from the risk of incurring liability for insider trading due to the usage of selectively disclosed information, a second strategy to be considered for subsidizing informed trading is based on regulatory action aimed at extending public companies' mandatory affirmative disclosure duties.<sup>364</sup> Both strategies encourage trading by fundamental informed investors,

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356. Letter from Karrie McMillan, Gen. Counsel, Inv. Co. Inst., to Elizabeth Murphy, Sec'y, U.S. Sec. & Exch. Comm'n (Apr. 21, 2010), <https://www.ici.org/pdf/24266.pdf>.

357. *Id.*

358. See Charles R. Korsmo, *The Audience for Corporate Disclosure*, 102 IOWA L. REV. 1581, 1630 (2017) (discussing the advantage to high-speed traders); Stanislav Dolgoplov, *Insider Trading: Informed Trading, and Market Making: Liquidity of Securities Markets in the Zero-Sum Game*, 3 WM. & MARY BUS. L. REV. 1, 17 (2012) (discussing the implication of short-term informed trading).

359. See Yadav I, *supra* note 16, at 1646 n.150 (discussing sources that analyze the impact of HFT on volatility).

360. See *supra* Part IV.C (examining the influence of HFT-related informational inequalities on market efficiency).

361. See generally Fox III, *supra* note 269, at 842 (noting that "fundamental informed trading's effect on price accuracy has a much larger positive impact on the functioning of the real economy and its capacity to provide society with goods and services.").

362. See Yadav I, *supra* note 16, at 1666 (discussing the importance of regulatory intervention).

363. 17 C.F.R. § 243.100 (2018).

364. See Steinberg, *supra* note 179, at 659–60 (discussing the duty to disclose).

and therefore seem theoretically capable of increasing the accuracy of market prices.<sup>365</sup> However, the pros and cons of these two approaches need to be adequately weighted up.

1. *Selective Disclosure of Material Non-Public Information, and the Possible Roadblock of Rule 10b5-2(b)*

To reduce information research costs, fundamental informed traders may directly access issuers' directors and management in order to request the information they need in order to carry out their analysis.<sup>366</sup> If material information is selectively disclosed to them, recipients will be protected from the risk of being front-run by HFTs, who cannot trade on the same information until it is publicly disclosed.<sup>367</sup>

Such a privileged pathway to information is already available to investors (and securities analysts), given that Reg FD does not definitely ban selective disclosure, and informational disparities are tolerated under the current disclosure regime.<sup>368</sup>

In this regard, it is worth recalling that the SEC decided to impose restrictions on selective disclosure when it became concerned about the practice of selectively disclosing material non-public information, such as advance warnings of earnings results communicated to securities analysts, selected institutional investors, or both, before the full disclosure of such information to the general public.<sup>369</sup> In the SEC's view, the practice of selective disclosure leads to a loss of investor confidence in the integrity of capital markets.<sup>370</sup> Accordingly, Reg FD prohibits issuers, or persons acting on an issuer's behalf, from selectively disclosing material inside information regarding the company or its securities to certain enumerated persons.<sup>371</sup> Reg FD defines a "person acting on behalf of an issuer" as "any senior official of the issuer . . . or any other officer, employee, or agent of an issuer who regularly communicates with any person described in § 243.100(b)(1)(i), (ii), (iii), or with holders of the issuer's securities."<sup>372</sup>

Despite these restrictions, issuers maintain a lot of room for selectively disclosing relevant pieces of information before they are revealed to the

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365. *Id.* at 657 ("According to the SEC, the Regulation has been sufficiently tailored. . . . [T]he discipline and culture of the securities markets will continue to induce issuers to disclose information necessary for investors to make informed decisions.")

366. Yadav III, *supra* note 179, at 1006–07.

367. *Id.* at 988.

368. Fisch, *supra* note 179, at 126.

369. *Id.*

370. 17 C.F.R. § 243.100(a) (2018).

371. *Id.*

372. 17 C.F.R. § 243.101(c). 17 C.F.R. § 243.100(b)(1) enumerates four categories of persons to whom selective disclosure may not be made absent a specified exclusion: a broker or dealer, or a person associated with a broker or dealer; an investment adviser, an institutional investment manager, or a person associated with either; an investment company or affiliated person thereof; [any person] who is a holder of the issuer's securities, under circumstances in which it is reasonably foreseeable that the person will purchase or sell the issuer's securities on the basis of the information.

public.<sup>373</sup> Empirical evidence supports the view that Reg FD curbed the information advantage enjoyed by certain investors and analysts, and leveled the playing field for all investors.<sup>374</sup> However, many studies have documented that, as a matter of fact, information asymmetries among investors persist, given, first, that Reg FD only focuses on the selective disclosure of material information, while allowing selective access to non-material information.<sup>375</sup> Secondly, the SEC has confirmed that Reg FD does not prevent the so-called “mosaic theory” from applying, according to which “an issuer is not prohibited from disclosing a non-material piece of information to an analyst, even if, unbeknownst to the issuer, that piece helps the analyst complete a ‘mosaic’ of information that, taken together, is material.”<sup>376</sup> Thirdly, and importantly, the prohibition on the selective disclosure of material information is not absolute in nature since, according to Reg FD, communications made to parties that agree to keep the information confidential are exempt from its scope.<sup>377</sup> Thus, issuers are significantly free to selectively disclose material information provided that, as the SEC itself suggests, an issuer who has mistakenly made a selective disclosure of material information attempts to avoid any resulting harm by obtaining from the recipient of that disclosure an agreement not to disclose or trade on the basis of the information.<sup>378</sup>

Consequently, Reg FD is widely considered to be incapable of meeting its underlying goals of preserving investors’ confidence and leveling informational inequalities.<sup>379</sup> This is clearly shown by the case—which failed to induce the SEC to react—of newswires providing paying subscribers with early access to corporate information.<sup>380</sup>

In addition, the very robustness of the fairness and ordinary investor protection rationale underlying the adoption of Reg FD is called into question. Aside from the fact that such a line of reasoning seems, to some extent, to be outdated within a context in which the SEC accepts several types of information inequalities, which contrast with the principle of investors’ equal access to

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373. 17 C.F.R. § 243.100(b)(2)(ii) (2014); see Jesse M. Fried, *Insider Trading Via the Corporation*, 162 U. PA. L. REV. 801, 809 (2014) (“[I]nsiders can profit legally by trading on many types of valuable, ‘sub-material’ information.”); Fisch, *supra* note 179, at 126 (“Issuers have adapted their disclosure practices to reflect the selective disclosure concerns reflected in Regulation FD.”).

374. Fisch, *supra* note 179, at 126.

375. 17 C.F.R. § 243.100(a); Fried, *supra* note 373, at 809.

376. Selective Disclosure and Insider Trading, Exchange Act Release No. 43,154, 65 Fed. Reg. 51,716, 51,722 (Aug. 24, 2000) [hereinafter SEC Selective Disclosure]; see Adam S. Koch et al., *Regulation FD: A Review and Synthesis of the Academic Literature*, 27 ACCT. HORIZONS 619, 638–42 (2013) (providing a survey of empirical evidence showing that private access to management continues to provide select analysts or investors with non-material information used to complete the “mosaic” of information).

377. 17 C.F.R. § 243.100(b)(2)(ii); see Stephen J. Choi, *Selective Disclosures in the Public Capital Markets*, 35 U.C. DAVIS L. REV. 533, 564 (2002) (noting that “Regulation FD allows managers to provide outside block shareholders the ability to benefit from *not* trading in securities . . . . An investor, for example, may intend to engage in a sale transaction, thereby disposing of part of its holdings in a particular company. Learning that the market undervalues the securities may lead the investor to forego the sale, retaining the undervalued securities for their financial benefit.”).

378. SEC Selective Disclosure, *supra* note 376, at 51720.

379. See *supra* Part IV.A (discussing the increase in information asymmetry and breaches of insider trading rules).

380. See *supra* Part I (discussing subscription to news wires and market data-feed services).

information underlying Reg FD, there is quite a large body of evidence to show that Reg FD affects the amount of information available to the market—especially in relation to small and high technology firms—and has led to a decline in the number of firms covered by analysts.<sup>381</sup> Furthermore, in contrast with its stated rationale, the simultaneous dissemination of material information required by Reg FD has been found to harm ordinary investors, as one recent study convincingly contends.<sup>382</sup> Despite the conventional wisdom that Reg FD protects ordinary investors, Haeberle and Henderson have developed a market-microstructure-based analysis showing that Reg FD, while reducing the risk that select group of traders will have superior information that others lack during the pre-release periods, dramatically increases and concentrates this same information asymmetry during the post-release periods.<sup>383</sup> Thus, ordinary investors who trade in the post-release periods, “are made markedly worse off as the execution of their orders to buy and sell stock are far more likely to be affected by better-informed pros in those periods than they would be without the legal intervention.”<sup>384</sup>

The arguments illustrated above convincingly establish that, when assessing the merits and demerits of selective disclosure, the SEC, and indeed also scholars, should not rely on the anecdotal fairness rationale underlying Reg FD, but should carefully consider the impact of restrictions on selective disclosure on market efficiency and investor well-being.<sup>385</sup> Moreover, potential remaining concerns related to the negative consequences of selective disclosure on market fairness can be easily overcome by requiring issuers to make reports concerning selective disclosure.<sup>386</sup> As professor Choi argues, regulators could require companies to report both the timing and the recipients of selective disclosures, although not the substantive contents of the disclosure.<sup>387</sup> A reporting obligation of this kind would enable other investors to be monitored, and should therefore both reduce the risk of opportunistic selective disclosure by issuers, and avoid repeated selective disclosures to the same recipients.<sup>388</sup>

However, it remains doubtful whether selective disclosure will be sufficient to incentivize trading by fundamental investors, thereby enhancing the allocative efficiency of HFT-dominated capital markets.<sup>389</sup>

First of all, it cannot be excluded that HFTs may be amongst the recipients of selective disclosure, and therefore still remain able to react earlier to the

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381. Susan B. Heyman, *Rethinking Regulation Fair Disclosure and Corporate Free Speech*, 36 *CARDOZO L. REV.* 1099, 1132–33. (2015); see Koch et al., *supra* note 376, at 623–35 (describing studies which provide evidence on whether Reg FD produces a chilling effect or leveled playing field).

382. See Haeberle & Henderson, *supra* note 178, at 1411 (discussing the effects of the information-dissemination law on ordinary investors).

383. *Id.* at 1378–79.

384. *Id.*

385. *Id.*

386. Choi, *supra* note 377, at 573.

387. *Id.*; see also Martin Bengtzen, *Private Investor Meetings in Public Firms: The Case for Increasing Transparency*, 22 *FORDHAM J. CORP. & FIN. L.* 33, 122–26 (2017) (suggesting the introduction of a requirement to report the fact that the firm made a disclosure mistake by selectively disclosing a piece of material information).

388. Choi, *supra* note 377, at 573–74; Bengtzen, *supra* note 387, at 122–23.

389. Choi, *supra* note 377, at 571.

information selectively revealed.<sup>390</sup> In order to avoid this possible drawback, a class-based selective disclosure regime would be needed, under which regulators could allow firms to engage in selective disclosures directed toward particular classes of market participants rather than specific participants.<sup>391</sup> Based on such an approach, regulators could force issuers to refrain from providing selective disclosure to investors that qualify as HFTs.<sup>392</sup> However, this would require the SEC to adopt a definition of high-frequency trading and also entail a registration requirement for HFTs.<sup>393</sup> All the same, the rule would be difficult to enforce.<sup>394</sup>

Most importantly, it is questionable whether selective disclosure to fundamental traders could actually enhance price accuracy.<sup>395</sup> As has been acknowledged by the SEC, a recipient of selectively disclosed pieces of information that trades on it before the information is revealed to the public runs the risk of incurring liability for insider trading.<sup>396</sup> In fact, when adopting Rule 10b5-2, the SEC tried to attach insider trading liability to a breach not just of fiduciary duties, but of contractual obligations as well.<sup>397</sup> Rule 10b5-2 lays down three non-exclusive bases for establishing whether a duty of trust or confidence is owed by the person receiving information.<sup>398</sup> Specifically, such a duty exists “whenever a person agrees to maintain information confidence.”<sup>399</sup> This approach is not uncontested, as some courts have objected that a confidentiality agreement regarding material non-public information does not by itself necessarily support a Rule 10b5-2 duty to disclose or to abstain from trading.<sup>400</sup> Still, the rule “remains a force to be reckoned with.”<sup>401</sup> In fact, it being understood that judicial clarification is needed,<sup>402</sup> a confidentiality agreement supports the misappropriation theory in precluding someone from trading while in possession of material nonpublic information, given that the

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390. *Id.* at 572.

391. *See id.* (adding that “regulators could force firms to establish bright-line eligibility criteria for market participants to receive selective disclosures and publicize the criteria.”).

392. *Id.*

393. ESMA HIGH-FREQUENCY TRADING, *supra* note 12, at 4.

394. Choi, *supra* note 377, at 572.

395. *See supra* Part II.B.2 (discussing the controversial impact of HFT on price accuracy).

396. SEC Selective Disclosure, *supra* note 376, at 51731.

397. Rules and Regulations Under the Securities Exchange Act of 1934, 17 C.F.R. § 240.10b5-2 (2017).

398. 17 C.F.R. § 240.10b5-2(b).

399. 17 C.F.R. § 240.10b5-2(b)(1).

400. *SEC v. Cuban*, 634 F. Supp. 2d 713, 730–31 (N.D. Tex. 2009), vacated and remanded, *SEC v. Cuban*, 620 F.3d 551, 557–58 (5th Cir. 2010); Brief of Amici Curiae in Support of Defendant’s Motion to Dismiss, *SEC v. Cuban*, 634 F. Supp. 2d 713 (No. 3:08-cv-02050).

401. Thomas Lee Hazen, *Identifying the Duty Prohibiting Outsider Trading on Material Nonpublic Information*, 61 HASTINGS L. J. 881, 896 (2010); *see also* Edward Greene & Olivia Schmid, *Duty-Free Insider Trading*, 2013 COLUM. BUS. L. REV. 369, 386–90 (2013) (“[T]he SEC construed SEC rule 10b5-2 . . . as a sufficient basis for imposing Section 10(b) liability, even in the absence of a preexisting fiduciary-like duty or an agreement not to trade.”).

402. *See* Joseph Pahl, *A Heart as Far from Fraud as Heaven from Earth: Sec. v. Cuban and Fiduciary Duties Under Rule 10B5-2*, 106 NW. U. L. REV. 1849, 1879–80 (2012) (asking for a clarification from the Supreme Court).

signing of such an agreement constitutes a representation as to how that information will be treated.<sup>403</sup>

## 2. *Extending Event-Driven Mandatory Disclosure Obligations*

Taking the possible drawbacks of the selective disclosure-based approach into account, an extension of public companies' mandatory disclosure obligations may also be considered a means of incentivizing fundamental traders by providing them with more frequent and cheaper information.<sup>404</sup> If issuers were required to disclose more information than at present, traders performing fundamental analysis would be given a double cost advantage.<sup>405</sup> Mandatory disclosure reduces information research costs, as well as trading costs, because disclosures enhance market liquidity by reducing, or eliminating, insiders' informed trading and the liquidity harm caused by such trading.<sup>406</sup> Increased information can also encourage analysis by fundamental traders, since any additional information received may constitute a valuable input into the process of further discovery.<sup>407</sup> Incentivizing informed traders leads to price accuracy and, consequently, enhanced liquidity, lower volatility, a reduced cost of capital for firms and a higher degree of market allocative efficiency, to the benefit of the economic system as a whole.<sup>408</sup> These arguments may induce regulators to consider that, in HFT-dominated markets, where informed traders stand at a disadvantage to faster traders, expanding access to information can offer a path forward that ultimately rewards informed investors.<sup>409</sup>

To this end, mandatory disclosure obligations should be extended by requiring more frequent and timelier, event-driven disclosure of material information.

Along the same lines, in 2004 the SEC adopted rules to increase the frequency of disclosures related to a number of key corporate events that involve material information, requiring issuers to file a Form 8-K "on a rapid and current basis."<sup>410</sup> The SEC further shortened the Form 8-K filing deadline for most items to four business days after the occurrence of the event triggering the disclosure requirements.<sup>411</sup> In addition, the SEC acknowledged that moving its rules towards a system that emphasizes current reporting may render markets

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403. Hazen, *supra* note 401, at 898 ("The person who then trades on the information has in effect misrepresented his or her intent in order to obtain the information, and that misrepresentation is sufficient to trigger Rule 10b-5 obligations.")

404. See Fox III, *supra* note 269, at 892–93 (discussing the relationship between mandatory affirmative disclosure to informed trading).

405. *Id.* at 61.

406. *Id.*

407. *Id.*

408. See generally Luca Enriques & Sergio Gilotta, *Disclosure and Financial Market Regulation*, in THE OXFORD HANDBOOK OF FINANCIAL REGULATION 512, 519 (Niamh Moloney et al. eds., 2015) (examining "the debate over mandatory disclosure to the general public as a regulatory technique for financial markets.")

409. Yadav I, *supra* note 16, at 1667–68.

410. Additional Form 8-K Disclosure Requirements and Acceleration of Filing Date, Securities Act Release No. 33-8400, Exchange Act Release No. 34-49424, 69 Fed. Reg. 15594, 15595 [hereinafter Additional Form 8-K Disclosure Requirements] (to be codified at 17 C.F.R. pts. 228, 229, 230, 239, 240 and 249).

411. *Id.* at 15594.

“more effective as price discovery mechanisms during periods between periodic report.”<sup>412</sup> In view of all of these factors, the introduction of an EU-like continuous, event-driven, disclosure regime should perhaps be considered.

Within the European context, Article 17 MAR sets out an obligation on issuers to disclose inside information promptly, in line with the parity of information principle.<sup>413</sup> Specifically, Article 17 MAR requires that, “[a]n issuer shall inform the public as soon as possible of inside information which directly concerns that issuer.”<sup>414</sup> Article 7 MAR defines inside information as an “information of a precise nature, which has not been made public, relating, directly or indirectly, to one or more issuers or to one or more financial instruments, and which, if it were made public, would be likely to have a significant effect on the prices of those financial instruments or on the price of related derivative financial instruments.”<sup>415</sup>

Although the U.S. mandates ongoing disclosure in relation to any of a specified list of events, whereas the EU does not specify the events which trigger disclosure, the distinction between the U.S. and the EU regime may be rather more modest.<sup>416</sup> In fact, the list of 8-K items set out by the SEC includes most of the events that can trigger ongoing disclosure obligations according to Article 17 MAR.<sup>417</sup> Therefore, the actual scope of event-driven disclosure obligations should not, as a matter of fact, be that different on each side of the Atlantic.<sup>418</sup> Furthermore, the EU mandatory disclosure regime does not impose a block on selective disclosure, since the duty to disclose set by Article 17 (1) MAR is not absolute.<sup>419</sup> Article 17 (8) MAR allows for selective disclosure according to rules comparable to those outlined by Regulation FD.<sup>420</sup>

On the other hand, a relevant difference between the European and the U.S. regimes seems to concern the timing of the disclosure.<sup>421</sup> Whereas Article 17 MAR prompts issuers to disclose inside information “as soon as possible”—unless the option to delay disclosure is invoked<sup>422</sup>—according to SEC rules,

412. *Id.* at 15611.

413. MAR, *supra* note 143, at 34.

414. *Id.*

415. *Id.* at 24; *see generally* NIAMH MOLONEY, EU SECURITIES AND FINANCIAL MARKETS REGULATION 730–36 (3d ed. 2014) (examining the new regulatory regime which applies to the EU financial market in the wake of the Global Financial Crisis).

416. *See* JOHN ARMOUR ET AL., PRINCIPLES OF FINANCIAL REGULATION 175–176 (2016) [hereinafter PRINCIPLES OF FINANCIAL REGULATION] (contrasting the regulatory approaches between the US and the EU).

417. Additional Form 8-K Disclosure Requirements, *supra* note 410, at 15594.

418. *Id.*; MAR, *supra* note 143, at 34.

419. MAR, *supra* note 143, at 34.

420. *Id.* at 36 (stating in Article 17(8) that, “where an issuer, or a person acting on their behalf or for their account, discloses any inside information to any third party in the normal course of the exercise of an employment, profession or duties as referred to in Article 10 (1), they must make complete and effective public disclosure of that information, simultaneously in the case of an intentional disclosure, and promptly in the case of a non-intentional disclosure. This paragraph shall not apply if the person receiving the information owes a duty of confidentiality, regardless of whether such duty is based on a law, on regulations, on articles of association, or on a contract.”).

421. *Id.*; Additional Form 8-K Disclosure Requirements, *supra* note 410, at 15594.

422. MAR, *supra* note 143, at 34–35 (stating in Article 17(4) that “an issuer . . . may, on its own responsibility, delay disclosure to the public of inside information provided that all of the following conditions are met: (a) immediate disclosure is likely to prejudice the legitimate interests of the issuer or emission allowance

companies have four business days to file a Form 8-K. Hence, corporate insiders can exploit the opportunity to delay disclosure, and trade on companies' shares before information is disclosed.<sup>423</sup> As it remains unclear why U.S. firms need so much longer to prepare announcements than their EU counterparts do,<sup>424</sup> a timelier disclosure of material information could favor their faster incorporation into market prices, increase price accuracy and reduce the time lag during which traders face the risk of trading on stale prices that do not reflect all existing material information.<sup>425</sup>

The proposed extension of ongoing mandatory disclosure obligations would require adjustments not so relevant and does not appear to present major drawbacks when compared to the current SEC rules.<sup>426</sup>

First, many of the events triggering disclosure duties under the EU regime are already covered by the 8-K filing obligation, and additional disclosures would only apply to material information.<sup>427</sup> Therefore, the risk that an extended ongoing mandatory disclosure regime could lead to information overload as a consequence of forcing issuers either to disclose too frequently or to disclose information that is useless for recipients appears to be remote.<sup>428</sup>

Second, it may be the case that expanding disclosure duties would shift costs from investors—who would save some information research cost—to issuers—which, in turn, would bear higher compliance costs, as well as liability for violating disclosure obligations.<sup>429</sup> In any case, such a relocation of costs may be regarded as acceptable from the standpoint of social wealth.<sup>430</sup> Within the current market context, the need to encourage fundamental traders to participate in financial markets seems to prevail over limiting issuers' costs.<sup>431</sup>

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market participant; (b) delay of disclosure is not likely to mislead the public; (c) the issuer or emission allowance market participant is able to ensure the confidentiality of that information.”).

423. See Alma Cohen, Robert J. Jackson & Joshua Mitts, *The 8-K Trading Gap* (Colum. L. & Econ. Working Paper No. 524, 2015), <https://ssrn.com/abstract=2657877> (describing how corporate insiders take advantage of this regulatory loophole to make profits by trading in companies' shares during the “8-K Trading Gap”).

424. See Armour et al., *supra* note 173, at 58 (explaining that U.S. firms take longer to prepare announcements than their EU counterparts).

425. See Merritt B. Fox, *Rethinking Disclosure Liability in the Modern Era*, 75 WASH. U. L. REV. 903, 909 (1997) [hereinafter Fox IV] (explaining in part that greater disclosure leads to an “increase in share price accuracy.”).

426. See Yadav I, *supra* note 16, at 1668; *Exchange Act Form 8-K*, SEC. & EXCH. COMM'N (Dec. 22, 2017), <https://www.sec.gov/divisions/corpfin/guidance/8-kinterp.htm> (providing general guidance on the interpretation of current SEC rules).

427. Additional Form 8-K Disclosure Requirements, *supra* note 410, at 15611; Yadav I, *supra* note 16, at 1668.

428. Additional Form 8-K Disclosure Requirements, *supra* note 410, at 15611.

429. *Id.*; Greene & Schmid, *supra* note 401, at 410. But see Dale Arthur Oesterle, *The Inexorable March Toward a Continuous Disclosure Requirement for Publicly Traded Corporations: Are We There Yet*, 20 CARDOZO L. REV. 135, 191–94 (1998) (arguing that a continuous disclosure regime would not necessarily generate increased litigation risk).

430. See IDRDEEP GHOSH, SOCIAL WEALTH ECONOMIC INDICATORS 21 (Center for Partnership Studies 2014), <http://caringeconomy.org/wp-content/uploads/2015/03/Social-Wealth-Economic-Indicators-Full-Report-20152.pdf> (explaining the concept of social wealth).

431. See Helen Allen, John Hawkins, & Setsuya Sato, *Electronic Trading and Its Implications for Financial Systems*, 7 BANK FOR INT'L SETTLEMENTS PAPERS 30, 46 (2001) (“Electronic trading systems may encourage issuers to standardize their offerings (which can concentrate liquidity), particularly in more heterogeneous securities such as fixed income.”).

Empirical evidence shows that, under pressure from HFTs and portfolio traders—i.e. index-based funds and exchange traded funds—the percentage of informed trading in the market is continuously falling.<sup>432</sup> Moreover, although there is a lack of empirical study, it seems that the overall cost impact of the solution proposed should be limited.<sup>433</sup> Anecdotal evidence suggests that, in order to minimize Reg FD-related compliance costs, “many issuers . . . adopt an affirmative policy to disclose material information, subject to exceptions such as when it is necessary to keep the information confidential or when the issuer has a legitimate business interest for not disclosing.”<sup>434</sup> Policies of this kind, which have been voluntarily adopted by a number of issuers, seem to be not so far from an EU-like regime, which likewise allows for the delayed disclosure of material information.<sup>435</sup> Although Article 17 MAR places the burden of providing the reason for delayed disclosure on the issuer, the adoption of EU-like disclosure obligations should not dramatically increase the risk that issuers may be compelled to make earlier disclosures than is desirable “out of a desire to avoid the cost and risks of a fight with regulators.”<sup>436</sup> It is worth considering in this regard that, where disclosure of information is delayed, which subsequently loses the element of price sensitivity, the issuer is not obliged to disclose that information publicly.<sup>437</sup>

Third, it is also the case that an extended event-driven mandatory disclosure regime may increase socially undesirable announcement trading<sup>438</sup> also by HFTs, which may frustrate long-term fundamental informed traders’ incentives. However, such an outcome could be limited if the information disclosure was postponed until after the end of regular trading hours and issuers were similarly constrained in their own announcements “absent a pressing need such as stemming a developing flood of trading by insiders and their tippees.”<sup>439</sup>

It being understood that empirical evidence is needed, which is lacking at present, the arguments illustrated above may suggest, in conclusion, that a widening of the reach of mandatory disclosure obligations may avoid the need to adopt measures designed to slow down HFTs, like those previously

432. See Haerberle & Henderson, *supra* note 178, at 1402–03 (“[T]he percentage of informed trading in the market in such times falls merely in the range of 5% or so.”).

433. See generally Jeff L. McMullin, Brian P. Miller & Brady J. Twedt, *Increased Mandated Disclosure Frequency and Price Formation: Evidence from the 8-K Expansion Regulation*, B.J. REV 1 (2018) (discussing the relationship between disclosure and improved price formation).

434. PRINCIPLES OF FINANCIAL REGULATION, *supra* note 419, at 176.

435. *Id.*

436. Fox III, *supra* note 269, at 894–95.

437. See EUR. SEC. MKTS. AUT., QUESTIONS AND ANSWERS ON THE MARKET ABUSE REGULATION (MAR) § A.5.2 (Nov. 21, 2017), [https://www.esma.europa.eu/sites/default/files/library/esma70-145-111\\_qa\\_on\\_mar.pdf](https://www.esma.europa.eu/sites/default/files/library/esma70-145-111_qa_on_mar.pdf) (discussing the relationship between price sensitivity and delayed disclosure of information).

438. See Fox III, *supra* note 269, at 847 (arguing that announcement trading’s capacity to increase the speed with which market prices reflect already existing information “is of socially insignificant benefit[,]” while its “negative social effects are substantial. Announcement trading has all the same negative efficiency effects from its adverse impact on liquidity as does any other type of informed trading. In addition, it consumes scarce resources—talented people and sophisticated equipment—that could be usefully employed elsewhere to provide goods and services of value to society. Its crowding out effect reduces the level of fundamental value informed trading, which is a socially desirable activity.”).

439. *Id.* at 892.

discussed.<sup>440</sup> In fact, no such measure has been adopted under European legislation, which may possibly be explained, at least in part, by the mandatory disclosure regime as a tool for smoothing over the speed imbalances that fundamental investors incur in due to HFT.<sup>441</sup>

## VI. CONCLUSION

Thanks to technological innovation and automation, trading on equity markets has changed dramatically over the past twenty years, while the relevant regulation remains slow to adapt.<sup>442</sup> Despite increasing liquidity and narrowing spreads, algorithmic and high-frequency trading can negatively impact market quality and stability, and render marketplaces more vulnerable, especially during crisis periods or under uncertain market conditions.<sup>443</sup>

Regulatory action that has either directly or indirectly targeted HFT has prioritized, in both the U.S. and in Europe, the prevention of market disruption and manipulation.<sup>444</sup> However, HFT also calls the principle of investors' information equality into question, challenging price informativeness in the longer run, along with real resource allocation.<sup>445</sup>

In fact, the current financial market context offers many ways of gaining early access to inside information and trading data.<sup>446</sup> Low-latency news wires and market data feeds, along with co-location, are available to any investor willing to pay for these services.<sup>447</sup> However, selling these services *de facto* determines information asymmetries among investors to the advantage of those, such as HFTs, who actually find themselves in a position to profit from early access to market-moving information due to their superior capacity and speed in processing information and trading upon new information before it reaches other investors.<sup>448</sup>

The resulting two-tier system of information dissemination is hard to reconcile with the principle of equal access to information underlying financial regulation in the U.S., as well as the EU.<sup>449</sup> Moreover, HFTs' structural advance in processing information can affect disclosure-based market efficiency, as theorized in the ECMH.<sup>450</sup>

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440. Mahoney & Rauterberg, *supra* note 45, at 44–45.

441. Yadav I, *supra* note 16, at 1616.

442. Adrian, *supra* note 91, at 279; Ryan Fuhrmann, *How Has The Stock Market Changed?*, INVESTOPEDIA (Nov. 10, 2011), <https://www.investopedia.com/financial-edge/1111/how-has-the-stock-market-changed.aspx>.

443. See *Regulatory Issues for High-Frequency Traders*, COMPLIANCE FOCUS, <http://compliancefocus.com/regulatory-issues-for-high-frequency-traders> (last visited Sept. 24, 2018) (discussing regulatory issues that HFT causes).

444. See generally Allen, *supra* note 98, at 10–21 (noting that SEC has adapted to innovations in HFT by adopting regulations aimed at insuring financial stability); ESMA ORDER DUPLICATION, *supra* note 9, at 5 (noting the adoption of the market in financial instruments directive (MiFID) as a response to HFT).

445. Gider, *supra* note 82, at 7.

446. Tracy & Patterson, *supra* note 203.

447. Haeberle & Henderson, *supra* note 178, at 1384–97.

448. See *supra* Part IV.B (discussing the reach of insider trading and disclosure rules).

449. *Id.*

450. See *supra* Part IV.A (discussing ECMH).

The SEC seems to tolerate information inequality deriving from newswires' early access arrangements which are often used as a source of corporate information dissemination.<sup>451</sup> Moreover, insider trading rules do not apply to early access to trade data, and paying subscription to direct market data feeds from the exchanges does not violate Rule 10b-5, or Reg FD.<sup>452</sup> In the EU too, where the principle of equal access to information is explicitly embraced by the MAR, the sale of faster access to proprietary feeds also falls outside the scope of insider trading rules.<sup>453</sup>

Information inequalities tolerated or accepted under the current insider trading and issuer disclosure rules affect financial markets efficiency and challenge the theoretical framework underlying the ECMH.<sup>454</sup> Due to reduced latency, early access to trade data allows HFTs to anticipate order flow and trade ahead of slower investors.<sup>455</sup> HFTs reduce informed traders' incentives to perform (costly) fundamental analysis, in that they erode the possibility to profit from the first-mover advantage gained through investing in fundamental research and analysis.<sup>456</sup> As a result of potentially reduced informed trading, market prices may become less informative, and negatively affect allocative efficiency.<sup>457</sup> Importantly, HFT is structurally inadequate for contributing to long-term price discovery, since trades are typically not, or only marginally, based on information concerning securities and their issuers, and the fundamental analysis of that information.<sup>458</sup>

In order to reduce HFT-related informational inequalities, minimizing information advances associated with market data feeds to prevent HFTs from exploiting aggressive trading strategies that ultimately micro-front-run slower investors may be achieved by either restricting the sale of market data feeds or slowing down HFT.<sup>459</sup>

Unlike a restriction of the sale of trade data feeds or a requirement for speed bumps, the replacement of the current continuous trading regime with a discrete-time trading regime based on frequent batched auctions would require radical changes to current equity market regulation.<sup>460</sup>

However, either of these measures may discourage HFT and weaken its positive effects in terms of increased liquidity and improved short-term price discovery.<sup>461</sup> Importantly, neither would definitely curb HFT-related risks concerning price long-term informativeness.<sup>462</sup>

If future empirical evidence were found to more strongly support HFT's negative impact on real resource allocation, regulators might consider taking

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451. Bullard, *supra* note 171, at 240.

452. 17 C.F.R. §§ 243.100, 243.103 (2014).

453. *See supra* Part IV.C (discussing the scope of insider trading rules).

454. *See supra* Part IV.C (discussing the challenges to the theoretical framework underlying ECMH).

455. Bank & Baumann, *supra* note 74, at 630.

456. *See supra* Part IV.C (discussing incentives to perform fundamental analysis).

457. *See supra* Part IV.C (discussing allocative efficiency).

458. *See supra* Part IV.C (discussing long-term price discovery).

459. Morelli, *supra* note 328, at 205.

460. *See supra* Part V.B (discussing a discrete-time trading regime).

461. *Supra* Part V.B.

462. *Supra* Part V.B.

action in order to alleviate the costly pressures suffered by fundamental traders in order to compete with HFT.<sup>463</sup> Supporting allocative efficiency within HFT-dominated equity markets by providing fundamental traders with more frequent and cheaper access to information may be taken into consideration according to two different, and to some extent opposing, strategies.

Subject to a confidentiality agreement, the selective disclosure of material non-public information is already available in order to reduce fundamental traders' information research costs.<sup>464</sup> However, given the potentially disincentivizing effect resulting from the risk of being faced with insider trading liability as a result of trading upon selectively disclosed information,<sup>465</sup> the SEC could also consider broadening the reach of public companies' mandatory disclosure obligations, and therefore introduce a continuous, event-driven, and faster disclosure regime. This solution would call for adjustments that are not as significant and would not appear to present major drawbacks when compared to the current SEC rules concerning issuer disclosure.

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463. Hazen, *supra* note 401, at 898.

464. SEC Selective Disclosure, *supra* note 376.

465. *See supra* Part V.B.1 (discussing insider trading liability).