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## Implementing High Frequency Trading Regulation: A Critical Analysis of Current Reforms

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*United States Court of Appeals for the First Circuit*

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# IMPLEMENTING HIGH FREQUENCY TRADING REGULATION: A CRITICAL ANALYSIS OF CURRENT REFORMS

Michael Morelli\*

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

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

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INTRODUCTION

This is the second comment in a two-part series offering a comprehensive approach for regulating secondary markets at a time when trading is getting faster and faster but spreads are getting narrower and narrower. The first comment summarized how secondary markets are currently structured, how many high frequency trading (HFT) strategies currently operate, and how regulators should go about thinking about the issues those strategies cause.<sup>1</sup> This comment expands on the first by offering critical analyses of current initiatives regulators are now considering which target many of those issues. As the reader shall see, the comment argues that many of these initiatives, though theoretically sound, will not succeed absent some level of domestic and international regulatory coordination.

I. HFT REGULATION GOING FORWARD

The landscape surrounding HFT is unsettled. Global regulators have enacted, proposed, or considered a wide range of measures targeting several of the problems discussed in the previous article, with more now under consideration. This section describes several of the measures in-depth, identifying whether they adequately address HFT-related issues and recommending which ones policymakers should keep, adopt, alter, or discard going forward.

*A. Measures Addressing Price Accuracy and Efficiency Issues*

Any plan to regulate HFT must encourage those strategies that promote effective price discovery and discourage those that do not. As a starting point, HFT strategies primarily relying on market orders will impute more information into securities' prices compared to those primarily relying on limit orders. Nonetheless, HFT strategies that heavily rely on market orders may damage the market in other ways, such as by trading

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1. Michael Morelli, *Regulating Secondary Markets in the High Frequency Age: A Principled and Coordinated Approach*, 6 MICH. BUS. & ENTREPRENEURIAL L. REV. 101 (2016).

against standing limit orders and decreasing overall liquidity levels. Accordingly, any solution needs to maximize the market order's inherent benefits while minimizing its potential costs, thus ensuring that securities trading remains based on fundamentals-based analysis rather than pure speed. Put another way, HFT strategies that discourage other market participants from generating and acting on new information should be discouraged, while those boosting such investment should be encouraged.

### 1. Minimum Resting Times

Minimum resting times specify the time that a limit order must remain in force. Theoretically, these delays increase the likelihood that a quote viewed by a market participant is available for a trade and provide better estimates of current market prices. Similarly, by making the limit order more risky from an adverse selection standpoint, minimum resting times reduce the profitability of manipulative HFT strategies while simultaneously incentivizing HFT firms to submit orders reflecting more fundamentals-based information. Mary Jo White, Chair of the U.S. Securities and Exchange Commission (SEC) from April 2013 to January 2017, had expressed, in her official capacity, qualified support for minimum resting times, arguing they would curb the excessive use of canceled orders by HFT firms.<sup>2</sup>

The broadness of these proposals present certain dangers. Professors Merritt Fox, Lawrence Glosten, and Gabriel Rauterberg for instance, chastise minimum resting times for ignoring the many legitimate reasons why HFT strategies rapidly cancel orders beyond electronic front running.<sup>3</sup> Beyond this heedlessness, it is unclear whether minimum resting times would achieve their desired effects. These limits impede arbitrage between markets and products at least to some extent, diminishing efficient price discovery. Similarly, instead of receding to the background, new types of manipulative HFT strategies would operate at slower, but just as harmful, intervals.

Minimum resting times would have other harmful effects as well. For instance, preventing traders from cancelling limit orders means that such orders are in constant danger of becoming stale and subject to adverse selection. Aggressive HFT strategies would likely submit market orders to execute against a stale standing limit order and immediately sell the shares at a higher price. The aggressive market order thus profits at the expense of the limit order, leading liquidity providers to increase spreads to hedge against this additional risk. Since market orders are typically more impactful with respect to price, decreased liquidity leads to larger price

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2. Mary Jo White, Chair, U.S. Sec. & Exch. Comm'n, Address at the Sandler O'Neill & Partners, L.P. Global Exchange and Brokerage Conference: Enhancing Our Equity Market Structure, Speech, (June 5, 2014), <http://www.sec.gov/News/Speech/Detail/Speech/1370542004312#.U5hzaihCw40>.

3. See Merritt B. Fox, Lawrence R. Glosten, & Gabriel V. Rauterberg, *The New Stock Market: Sense and Nonsense*, 65 DUKE L. J. 191 (2015).

changes when a particularly aggressive market order hits a trading venue. Thus, it is not surprising that other jurisdictions, like Australia and Europe, have rejected minimum order resting times.<sup>4</sup>

## 2. Minimum Order-to-Execution Ratios

Minimum order-to-execution ratios impose limits on a trader's ability to send orders to the market. Once they hit the ratio's limit, these traders have to participate in a trade before submitting any new orders. The potential benefits of these ratios mirror those of minimum resting times: the limit order book would likely be more stable since it would be harder to cancel orders, providing the market with better, more accurate price estimates. However, unlike minimum resting times, traders wishing to submit limit orders are not forced into a situation where they face adverse selection risk. So long as the trader remains below the ratio, they can cancel these orders at any time, meaning there is a smaller windfall to predatory HFT strategies using market orders.<sup>5</sup>

One concern is that these ratios would also affect other beneficial HFT trading strategies. Again, Fox et al. note that HFT firms revise quotes for many non-manipulative purposes.<sup>6</sup> Statistical arbitrage strategies, for example, naturally trigger cancellations and resubmissions to reduce price discrepancies, and a restrictive minimum order-to-execution ratio could be stifling. Moreover, as with minimum resting times, certain order-to-execution ratios could cause ETF and derivatives valuations to become unaligned due to decreased arbitrage activity, resulting in less accurate prices and net efficiency losses.

An overly restrictive ratio would likewise undermine other market functions. Many algorithmic trading strategies seek to reduce trade execution costs by splitting large orders into smaller pieces and by sending orders to markets in different amounts and at different times.<sup>7</sup> As orders execute or languish, the execution strategy recalibrates, leading to cancellations and resubmissions. This trading approach reduces costs for traders and leads to greater efficiency in execution, but improperly restricting its use would likely lead to higher spreads. Meanwhile, too low a ratio will result in traders sending fewer limit orders to the market, reducing overall liquidity.

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4. Adam Haigh, *ASIC Scraps Minimum-Resting-Time Plan for Equity Trade Orders*, BLOOMBERG (May 29, 2013), <http://www.bloomberg.com/news/articles/2013-05-30/asic-scraps-minimum-resting-time-plan-for-equity-trade-orders>; Philip Stafford and Alex Barker, *EU Clampdown on 'flash boy' traders turns technical*, FIN. TIMES (Apr. 14, 2014), <http://www.ft.com/intl/cms/s/0/40afcd9c-c3e3-11e3-870b00144feabdc0.html#axzz41r4GrRSS>.

5. J. Doyme Farmer & Spyros Skouras, *MINIMUM RESTING TIMES AND TRANSACTION-TO-ORDER RATIOS: REVIEW OF AMENDMENT 2.3.F AND QUESTION 20*, U.K. GOV'T OFF. SCI. (2012).

6. See Fox, et al., *supra* note 3.

7. *Id.*

Consequently, regulators can choose between two approaches. First, regulators can set the ratio at a relatively high level. This reduces the likelihood that the ratio would improperly inhibit good HFT strategies, though any efficiency gains would be relatively inconsequential. Second, regulators could differentiate order-to-trade ratios based on strategy and historical trading activity. This option would depend on regulators getting more information from HFT firms through registration, discussed in Part I.C.3. Fox et al. do not consider whether more HFT-related trade data would lead to more informed ratios.<sup>8</sup> However, after gathering this data, regulators could effectively charge both exchanges and HFT firms with setting and enforcing reasonable and appropriate order-to-execution ratios during various market conditions based on their historical trading patterns and strategies. Such an obligation would result in more tailored regulation, preserve regulatory resources, and ensure beneficial HFT strategies can continue to operate freely.

### 3. Frequent and On-Demand Batch Auctions

One of the more novel proposals under consideration involves replacing the current continuous trading system with frequent batch auctions. Professors Eric Budish, Peter Cramton, and John Shim, for instance, produced a plan where securities trading would consist of sealed-bid auctions conducted at discrete time intervals, e.g., every second.<sup>9</sup> They argue that continuous time auctions regularly create opportunities for latency arbitrage since a trader will always benefit by being at the top of an order book.<sup>10</sup> As a result, the status quo rewards HFT firms that continuously flood markets with orders since the emphasis is on speed, not on price. In contrast, batch auctions process orders received during a fixed time interval simultaneously, which means that “if multiple traders observe the same information at the same time, they are forced to compete on price instead of speed.”<sup>11</sup> Similarly, since batch auctions make it more difficult for HFT strategies to determine if the trading venue will execute their order, each trade would be more risky. Thus, batch 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. Perhaps most importantly, the market structure would also no longer incentivize HFT firms to invest as many resources in speed-focused technologies that contribute little social benefit.

Many jurisdictions are seriously considering variations of these frequent batch auctions. The London Stock Exchange, for instance, tested a

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8. *Id.*

9. See Eric B. Budish, Peter Cramton, & John J. Shim, *The High-Frequency Trading Arms Race: Frequent Batch Auctions as a Market Design Response*, 130 Q. J. OF ECON., 1547, 1617-18 (July 23, 2015).

10. *Id.* at 1547-48.

11. *Id.* at 1556.

midday auction program in some of its most liquid securities,<sup>12</sup> and the SEC has approved the Chicago Stock Exchange's plan to launch a batch-auction platform called CHX SNAP.<sup>13</sup> At least in the United States, however, these auctions face significant implementation hurdles. Specifically, it is unclear how multiple discrete batch auctions across different trading venues would interact with each other under existing United States law. As in most equity markets, United States broker-dealers have a duty of "best execution" when acting on behalf of a client.<sup>14</sup> This duty obligates broker-dealers to attain the most advantageous terms for their clients.<sup>15</sup> Rule 611 of Regulation NMS forces broker-dealers to first route an order to an exchange providing the national bid and best offer (NBBO), partially assuring best execution. Exchanges post quotes in continuous limit order books, making it possible for broker-dealers to make sure they submit an order to the venue with the best price at a particular time. In contrast, a multiple exchange, frequent batch auction system determines prices only at the end of a batch interval, meaning a broker-dealer cannot know in advance which venue will yield the best price.<sup>16</sup>

Even assuming the SEC could change Regulation NMS, every exchange would have to run its auctions simultaneously to completely shift HFT competition from speed to price. Absent such coordination, latency arbitrage opportunities across markets and products would remain commonplace. For instance, a batch auctioneer would need to synchronize a stock's processing time with the processing times of its associated derivatives. Likewise, latency arbitrage could still occur with respect to ETFs since these auctioneers would need to synchronize every ETF's batch auction with its component stocks, an almost impossible feat.

Synchronized batch times would also be undesirable from an efficiency standpoint since optimal batch trading intervals, at least with respect to

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12. Press Release, London Stock Exch., London Stock Exchange To Launch Midday Auction (Nov. 11, 2014) (on file with author), <http://www.lseg.com/resources/media-centre/press-releases/london-stock-exchange-launch-midday-auction>.

13. See Order Approving CHX Proposed Rule Change to Implement Intra-Day and On-Demand Auction Service, Exchange Act Release No. 76087, 80 Fed. Reg. 61540 (Oct. 6, 2015), <https://www.gpo.gov/fdsys/pkg/FR-2015-10-13/pdf/2015-25886.pdf>.

14. See INT'L ORG. OF SEC. COMM'NS, REGULATORY ISSUES RAISED BY CHANGES IN MARKET STRUCTURE 12-13 (2013), <http://www.iosco.org/library/pubdocs/pdf/IOSCOPD431.pdf>.

15. See *Newton v. Merrill Lynch*, 135 F.3d 266, 270 (3d Cir. 1998) (en banc); Payment for Order Flow, Exchange Act Release No. 34902, 59 Fed. Reg. 55006, 55007 at n.15 (Nov. 2, 1994); FINRA Rules, FIN. INDUS. REG. AUTH., Rule 5310, [http://finra.complinet.com/en/display/display\\_main.html?rbid=2403&element\\_id=10455](http://finra.complinet.com/en/display/display_main.html?rbid=2403&element_id=10455) [hereinafter FINRA Rules].

16. Markus Baldauf & Joshua Mollner, *Trading in Fragmented Markets* 40 (Stanford Inst. for Econ. Pol'y Research Discussion Paper No. 15-018 2015), <http://www-siepr.stanford.edu/repec/sip/15-018.pdf>.

liquidity, vary by security.<sup>17</sup> And from a systemic risk standpoint, market interconnectivity would increase dramatically, intensifying the risk of system-wide disruptions. For example, issues in one market (e.g. the equities market) could spill over into other markets (e.g. the options or futures market) with more rapidity and frequency.

Still, variants of the Budish et al. auction model could complement and improve on continuous trading dynamics. One possible solution would involve making batch auctions an on-demand function limited to large trades. PDQ, an alternative trading system, currently uses a trader-initiated auction system for security orders.<sup>18</sup> The system negates synchronization problems and protects large institutional orders from predatory, latency-exploitive HFT strategies. As an example, John submits a market or marketable limit order to PDQ to buy 4,000 IBM shares. Over the next five to 20 milliseconds, depending on how fast John wishes his execution to be, PDQ solicits liquidity for the trade by sharing only the stock's name with liquidity providers, keeping order direction, size, and price hidden.<sup>19</sup> The trading venue aggregates HFT-submitted contra-side orders in response to the solicitation at specific price levels at or within the NBBO. PDQ then processes the auction, and 3,500 shares execute at these prices. Depending on John's preferences, PDQ either keeps the remaining order for 500 shares on its order book, routes it to another trading venue for execution, or has it cancelled.

Expanding these auctions to exchanges would present significant, but not insurmountable, technical obstacles. On-demand batch auctions assume the national limit order book's existence to determine at what prices these auctions can clear. But under current rules, on-demand auction runners would need to disseminate auction orders to the national limit order book and include them in the NBBO, despite these quotes not being immediately executable or available to everyone. In response, crafty HFT strategies might send orders to both the auction and the continuous order book to shift the NBBO in a particular direction.

To fix the latter problem, auction orders should have to meet minimum size thresholds (e.g., 500 shares) and be noncancelable. If the auction time is set at a short-enough time period, these restrictions make it extremely risky for traders to try to manipulate the NBBO, especially without knowing the size or direction of the auction trade. With respect to the former

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17. See Daniel Fricke & Austin Gerig, *Too Fast or Too Slow? Determining the Optimal Speed of Financial Markets* 29-30 (Aug. 31, 2016), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2363114](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2363114).

18. CODA Block, PDQ, <https://www.pdqenterprises.com/wp-content/uploads/2016/09/CODABlockProductSheet.pdf> (last visited Feb. 28, 2017); *Auction1 On-Demand Auctions from PDQ ATS*, PDQ, [http://www.pdqats.com/wp-content/uploads/2013/10/Auction1\\_2014\\_WEB.pdf](http://www.pdqats.com/wp-content/uploads/2013/10/Auction1_2014_WEB.pdf) (last visited Feb. 28, 2017); CODA Micro, PDQ, <https://www.pdqenterprises.com/wpcontent/uploads/2016/09/CODAMicroProductSheet.pdf> (last visited Feb. 28, 2017).

19. For larger trades, PDQ offers another on-demand auction service that extends the auction's length to up to 30 seconds. See CODA Block, *supra* note 18.

problem, exchanges should still transmit these quotes to the market but tag them as auction orders. The SEC could then amend Rule 611 and exempt these orders from inclusion in the NBBO calculation.<sup>20</sup>

This proposed exemption would be appropriate because on-demand auctions have characteristics of a slow market. A slow market occurs when an exchange does not execute trades in a particular security at the fastest possible speed. Currently, Rule 611 only protects quotations that are at the top of an order book and immediately accessible electronically, meaning slow market quotes are not included in the NBBO.<sup>21</sup> Since auction orders are also not immediately accessible or executable, it makes sense to exclude these submitted quotes from the NBBO as well. The NBBO would still protect auction execution prices and eliminate the reverse fear of trading through the rest of the market.

The SEC originally enacted Rule 611 to push exchanges to become electronic and automated, guaranteeing that investors always received the best possible price.<sup>22</sup> While on-demand auctions may hinder Regulation NMS' historical vision of universal "fast" markets, they give HFT liquidity providers more incentives to compete based on price, while the continuing availability of a continuous market ensures that traders can still get nearly immediate execution. These auctions also ensure that markets for different but related securities like equities, derivatives, futures, and ETFs can continue to operate independently. Regulators would not need to make any radical changes to Regulation NMS either, since the national limit order book would still drive trading both inside and outside of these auctions. In short, on-demand auctions promote Rule 611's true goals, price protection and increased competition.

Admittedly, getting HFT firms to engage with these systems will be a tall task so long as continuous order systems exist. This result would be undesirable because non-aggressive HFT order flow benefits non-HFT traders via liquidity promotion and price competition. Auction-runners, however, can address this potential problem in two ways. First, auction runners could give HFT firms with higher liquidity rebates when their orders execute in a batch auction. Still, this solution is not entirely satisfactory; it would increase market complexity, skew broker-dealer incentives with respect to best execution, and fail to discourage HFT firms from inundating the auction platform with quotes (although restricting their ability to cancel submitted orders might). A better approach would piggyback off an HFT algorithm registration proposal, discussed later in the comment, where firms would register specific algorithms with a regulator. As part of this process, the regulator would only allow passive market-making HFT algorithms to enter these auctions. If enough institutional trading

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20. 17 C.F.R. § 242.611(d) (2017).

21. See 17 C.F.R. § 242.611(a) (2017).

22. See Morelli, *supra* note 1, at 107-14.

activity migrates to on-demand auctions, research suggests that HFT will follow.<sup>23</sup>

### B. *Measures Addressing Liquidity and Volatility Issues*

As discussed in the first article, evidence suggests that HFT's benefits are limited to certain measures of liquidity and volatility in particular trading environments, and even then only with respect to specific types of securities.<sup>24</sup> Accordingly, regulators must determine how HFT can optimally increase liquidity in historically illiquid stocks and reduce volatility during periods of market stress.

#### 1. Financial Transaction Taxes

Many scholars and government officials, including Joseph Stiglitz and Hillary Clinton, have called on regulators to impose a small tax on every order.<sup>25</sup> Financial transaction taxes, like other taxes, reduce the amount of the taxed activity.<sup>26</sup> Thus, a financial transaction tax theoretically discourages frivolous orders and encourages traders to base their trades on a stock's fundamentals, not their short-term price movements.<sup>27</sup> Proponents say the tax would limit the effectiveness of manipulative HFT strategies, discourage excessive investment in financial market infrastructure, and encourage market participants to shift towards longer-term investment strategies where the tax consequences will be less consequential.<sup>28</sup> As of 2014, 11 of the 28 European Union countries had agreed to adopt a version of these taxes, joining many other jurisdictions in Asia, Africa, and North America.<sup>29</sup>

However, financial transaction taxes can generate substantial economic distortions and unintended consequences, the most obvious being that

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23. See generally Elaine Wah, Dylan Hurd & Michael Wellman, *Strategic Market Choice: Frequent Call Markets vs. Continuous Double Auctions for Fast and Slow Traders*, in *THIRD CONFERENCE ON AUCTIONS: MARKET MECHANISMS AND THEIR APPLICATIONS* 13 (Scott D. Kominers & Lirong Xia eds. 2015) (“[T]he fast traders chase agents into either market, and slow traders under pursuit seek the protection of the frequent call market.”).

24. Morelli, *supra* note 1, at 124-26.

25. JOSEPH E. STIGLITZ, *REWRITING THE RULES OF THE AMERICAN ECONOMY* 8, 69 (Roosevelt Inst. 2015), <http://rooseveltinstitute.org/wp-content/uploads/2015/10/Rewriting-the-Rules-Report-Final-Single-Pages.pdf>; Press Release, Hillary for America, Hillary Clinton: Wall Street Should Work for Main Street 7 (Aug. 7, 2015), <https://m.hrc.onl/briefing/Hillary-Clintons-Wall-Street-Agenda.pdf>.

26. See generally Leonard E. Burman et al., *Financial Transaction Taxes in Theory and Practice*, 69 *NAT'L TAX J.* 171 (2016).

27. See, e.g., John Fullerton, *High-frequency Trading is a Blight on Markets That the Tobin Tax Can Cure*, *THE GUARDIAN* (Apr. 4, 2014), <https://www.theguardian.com/business/economics-blog/2014/apr/04/high-frequency-trading-markets-tobin-tax-financial-transactions-algorithms>.

28. *Id.*

29. *Id.*

they are likely to increase the cost of funding for the real economy.<sup>30</sup> Similarly, market actors might simply pass these costs to investors, meaning the financial transaction tax is essentially a tax on investors. Even if jurisdictions pass targeted taxes imposed only on firms that have excessively high order-trade ratios, HFT firms could simply avoid the tax by relocating their operations to another exchange in another jurisdiction.<sup>31</sup> In short, policymakers should shelve the financial transaction tax given the practical and political difficulties involved in setting up a global tax and the availability of other effective but less contentious policy options.

## 2. Small-Cap Tick Size Pilot Program

Because evidence suggests that HFT has boosted liquidity for some securities but not others, regulators are considering ways to harness HFT to increase liquidity more broadly. The SEC's Small-Cap Tick Size Pilot Program is one such experiment.<sup>32</sup> In October 2016, the SEC began a two-year test program to see whether trading small-cap stocks in wider increments would improve liquidity for these stocks.<sup>33</sup> The test temporarily rolls back the effects of “decimalization,” or trading in penny increments, for this segment of the market.

The pilot program includes stocks of companies that have market capitalizations of \$3 billion or less, average daily trading volumes of one million shares or less, and a volume weighted average price of at least \$2.00.<sup>34</sup> The SEC placed 1,400 stocks in a control group that will still trade in penny increments. One separate test group will include stocks quoted in \$0.05 increments but capable of being traded at any price, while a second control group includes stocks that are both quoted and traded in \$0.05 increments. A final test group tests the “trade-at” rule, which requires market participants to execute trades in these securities on an exchange unless other non-exchange venues (e.g., dark pools and Electronic Communication Networks (ECNs)) offer a “meaningfully” better price.<sup>35</sup>

The conceptual foundation of the program is quite clear. The current one-size-fits-all tick size regime subjects smaller issuers to the same trading framework as larger, multinational companies with much higher trading volumes and market caps. Instead, regulators and exchanges should

30. Zsolt Darvas & Jakob Von Weizsäcker, *Financial Transaction Tax: Small is Beautiful*, BRUEGEL POL'Y CONTRIBUTION, Feb. 2010, at 12-13, [http://aei.pitt.edu/12885/1/pc\\_tobin\\_tax\\_080210.pdf](http://aei.pitt.edu/12885/1/pc_tobin_tax_080210.pdf).

31. *See infra* Part II.

32. See Order Approving the NMS Plan to Implement a Tick Size Pilot, Exchange Act Release No. 74892, 80 Fed. Reg. 2714, 27546-53, (May 13, 2015), <https://www.gpo.gov/fdsys/pkg/FR-2015-05-13/pdf/2015-11425.pdf>.

33. SEC, Investor Alert: Tick Size Pilot Program – What Investors Need To Know (Oct. 3, 2016), [https://www.sec.gov/oiea/investor-alerts-bulletins/ia\\_ticksiz.html](https://www.sec.gov/oiea/investor-alerts-bulletins/ia_ticksiz.html).

34. *Tick Size Pilot Program*, FINRA, <http://www.finra.org/industry/tick-size-pilot-program> (last visited Feb. 12, 2017).

35. *Id.*

tailor trading regimes to the liquidity needs of the issuer. Wider tick sizes result in wider spreads, making it more costly to trade. At least with respect to small-cap stocks, higher costs might lead to increased efforts by both human and high frequency traders to capture the spread, in turn adding more bids and offers to the order book. Deeper order books increase liquidity, incentivizing investment banks to underwrite more IPOs and fund more research coverage. Of course, if regulators set the minimum tick size too high, trading activity could migrate towards off-exchange trading venues. The trade-at rule, however, ensures that more trading in these securities happens on exchanges, improving transparency and price discovery.

Most existing literature examining the effect of tick sizes on trading pre-dates HFT's rise in the marketplace.<sup>36</sup> Theoretically, however, HFT firms are attracted to stocks with smaller tick sizes because there are more increments in which a share can move, thus producing more trading opportunities. Wider tick sizes make it more expensive for HFT firms to enter and exit a given trading position, meaning HFT strategies trading in these stocks would likely slow down: HFT would send fewer quotes to the market, but HFT would likely not cancel and replace these quotes as often.<sup>37</sup> Whether this would improve or hurt liquidity is an empirical question, one the data gathered from the pilot program might help answer.

But why should the pilot program be limited to small-cap stocks? Many large-cap stocks rarely, if ever, trade at penny increments. Why not explore different tick sizes for these stocks as well? For that matter, why base tick sizes off capitalization at all? Exchange-led self-regulatory initiatives in Europe, for instance, have largely harmonized tick sizes based on price levels.<sup>38</sup> The European Union's Amendments to the Markets in Financial Instruments Directive (MiFID II) formalizes this framework by basing tick size on share price and other liquidity factors based on the average number of trades per day.<sup>39</sup> The system aims to find a better compromise between the liquidity pooling in tick-size buckets while maintaining enough granularity to avoid long trading queues. Since evidence suggests that HFT's liquidity benefits do not extend to high volatility stocks regardless of their capitalization, the SEC should at least investigate a similar approach.<sup>40</sup>

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36. For an empirical study on the topic, see Alex Frino, Vito Mollica & Shunquan Zhang, *The Impact of Tick Size on High Frequency Trading: Evidence from Stock Splits*, (May 18, 2015), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2607391](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2607391).

37. *Id.* at 10-11.

38. Sviatoslav Rosov, *2 Fast 2 MiFID: What Does Brussels Have in Store for HFT*, CFA INST. (Oct. 19, 2015), <https://blogs.cfainstitute.org/marketintegrity/2015/10/19/too-fast-to-mifid-ii-what-does-brussels-have-in-store-for-hft/>.

39. Council Directive 65/349, art. 49, 2014 O.J. (L 173) 149 [hereinafter MiFID II]; *Commission Proposal for a Regulatory Technical Standard in the Tick Size Regime for Shares, Depositary Receipts, and ETFs*, at 3-4, COM (2016) 4389 final (July 14, 2016).

40. See Jonathan Brogaard, Terrence Hendershott, & Ryan Riordan, *High-Frequency Trading and Price Discovery*, 27 REV. FIN. STUD. 2267 (2014).

### 3. Market-Making Obligations

Market-making obligations would direct a trader acting as a market maker to post prices to buy and sell at competitive levels at all times a trading venue is open regardless of market conditions.<sup>41</sup> HFT firms currently face no regulatory obligation to make markets.<sup>42</sup> Exchanges have some market-making rules but “no true affirmative quoting or trading requirements.”<sup>43</sup> Even in the limited circumstances where market participants have to enter quotes, “the current system le[ads] to practices like ‘stub-quoting,’ in which a trader quotes way outside the price range of a particular stock just to meet minimal market making requirements.”<sup>44</sup>

A market-making obligation could take several forms: HFT market makers might be required to remain in the market for a certain length of time during the trading day, quote securities of a minimum market capitalization, and/or quote prices that are at or within an exchange’s best bid and offer for a minimum percentage of the trading day.<sup>45</sup> Obligations to set competitive prices could help reduce volatility, both on an individual and system-wide level. Requirements to stay in the market continuously, meanwhile, could improve liquidity provision by ensuring security prices remain actively quoted during periods of market stress. To the extent that these obligations improve the depth of the market through minimum quote size requirements, traders would also find it easier to buy and sell, lowering transaction costs and bolstering liquidity.

Nonetheless, market-making is not a costless enterprise. All market makers face situations where they face the risk of large losses. These costs are exacerbated when HFT market-making strategies conduct cross-market and cross-product trading. Historically, exchange rules resolved to

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41. Oliver Linton, Maureen O’Hara & J.P. Zigrand, *Economic Impact Assessments on MiFID II Policy Measures Related to Computer Trading in Financial Markets* 17-21 (U.K. Gov’t Off. Sci., Foresight Project, Working Paper No. 12/1088, 2012), [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/289075/12-1088-economic-impact-mifid-2-measures-computer-trading.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/289075/12-1088-economic-impact-mifid-2-measures-computer-trading.pdf).

42. Liz Moyer, *High-Frequency Firms Urge SEC to Add to Market-Makers’ Obligations*, FORBES (Jul. 13, 2010), <http://www.forbes.com/sites/streettalk/2010/07/13/high-frequency-firms-urge-sec-to-add-to-market-makers-obligations/#775bc43e29bb>

43. Letter from John A. McCarthy et al., Gen. Counsel, GETCO, LLC, to Robert Cook, Dir., Div. Trading & Mkts, U.S. Sec. & Exch. Comm’n (July 9, 2010), <https://www.sec.gov/comments/s7-02-10/s70210-255.pdf>.

44. Moyer, *supra* note 43.

45. As an example, under MiFID II in the E.U., member states are required to guarantee its regulated markets have in place written agreements with all investment firms pursuing a market-making strategy. Firms trigger these obligations when dealing in their own account post simultaneous two-way quotes of comparable size and competitive prices in at least one security on one trading venue for at least 50% of daily trading hours. These agreements must also compel the market maker to continue quoting in this way, although they can also state that market makers may exit the market during “exceptional circumstances,” which are determined by individual trading venues. *Commission Proposal for a Regulatory Technical Standard Specifying Requirements for Market Making*, at 6-9, COM (2016) 3523 final (June 13, 2016).

give market makers certain benefits to compensate them for the risk inherent in their market-making obligation. To the extent that rules impose these obligations without corresponding compensation, at least some market makers will exit, reducing liquidity.

Similarly, market-making during stressful conditions is tremendously risky. Requiring HFT market makers to buy when prices are crashing may lead them to exit the market, but this time not on their own accord.<sup>46</sup> More significantly, any HFT market-making obligations face significant definitional issues. What exactly would it mean to maintain “quotes” in the market? If the definition is too vague, HFT firms could simply evade the requirements by posting one quote on the side of the market on which it wishes to take a position and posting another on the other side away from competitive prices (called “stub quotes”). In other words, the quality of the available liquidity would not improve. And finally, as Fox et al. note, “historical evidence suggests that strong paper obligations have proved insufficient in the past to motivate market makers to continue supplying liquidity during periods of extreme volatility,” indicating that any obligation would be near impossible to enforce.<sup>47</sup>

Nonetheless, it is telling that major HFT firms have urged the SEC to impose stricter market-making obligations.<sup>48</sup> As these firms acknowledge, “additional market maker obligations will significantly reduce the chance of another destabilizing event,” suggesting the costs of a well-defined obligation are not prohibitively high.<sup>49</sup> To that effect, regulators should require HFT firms who qualify as market makers to quote at or inside the NBBO for a certain percentage of the trading day based on the price, liquidity, and volatility characteristics of the security. Regulators should also use these characteristics to set minimum quote size (e.g. 200, 500, or 1000 shares) and market depth obligations (e.g. 3-5 price levels below the applicable price obligation). There should similarly be a maximum quote length requirement to fix issues with stub quotes. Finally, to remedy Fox et al.’s enforcement concerns, trading venues could compensate HFT firms for their increased market making by altering their maker-taker systems, discussed below.

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46. The MiFID II proposal wisely allows market makers to exit the markets during “exceptional circumstances” as determined by individual trading venues. See Tony Katz & Puesan Lam, *MiFID II: Microstructural Issues*, DLA PIPER (Oct. 2015), [https://www.dlapiper.com/~media/Files/Insights/Publications/2015/10/DLA%20Piper\\_MiFID%20II\\_Microstructural%20Issues\\_October%202015.ashx](https://www.dlapiper.com/~media/Files/Insights/Publications/2015/10/DLA%20Piper_MiFID%20II_Microstructural%20Issues_October%202015.ashx).

47. See Fox, et al., *supra* note 3.

48. See McCarthy et al., *supra* note 44.

49. *Id.*

#### 4. Dynamic Maker-Taker Fees

Another intriguing option involves altering the existing maker-taker fee programs offered by most trading venues.<sup>50</sup> Many have criticized the current maker-taker system on conflict of interest,<sup>51</sup> market transparency, and market complexity grounds.<sup>52</sup> Accordingly, most calls for reform in this area either propose lowering the maker-taker fee cap,<sup>53</sup> currently set at \$0.003 per share,<sup>54</sup> or outright prohibiting the payment of rebates altogether.<sup>55</sup> Both sets of proposals, however, overlook the potential benefits of dynamic fees. By making these fees more customizable, exchanges can incentivize liquidity provision at key times. For instance, Blackrock, the world's largest asset manager, recently suggested that highly-liquid securities might not need as high a rebate compared to less liquid securities, and that therefore fees should be limited to thinly-traded securities.<sup>56</sup> Similarly, allowing for larger maker-taker fees when trading in categories of illiquid, small-cap stocks will make capital raising easier for small businesses, benefitting the overall economy.

Still, trading platforms would have to tread carefully when setting the maker-taker fee tiers or else risk depriving thinly-traded securities of any liquidity benefits. For example, BATS recently proposed segmenting maker-taker fees based on a variety of security-specific factors, including its average daily volume, market capitalization, inclusion in certain broad market indices, security type, or some combination thereof.<sup>57</sup> The SEC is

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50. See Open Letter, BATS, Market Structure Reform Discussion, at 3-4 (Jan. 6, 2015), <http://cdn.batstrading.com/resources/newsletters/OpenLetter010615.pdf> (discussing BATS' suggested tiered approach to access fees).

51. See, e.g., Letter from Sen. Carl Levin, to Mary Jo White, Chair, SEC (July 9, 2014), [www.hsgac.senate.gov/download/levin-letter-to-sec-chairman-mary-jo-white-re-equity-market-structure-july-15-2014](http://www.hsgac.senate.gov/download/levin-letter-to-sec-chairman-mary-jo-white-re-equity-market-structure-july-15-2014); *U.S. Senator Seeks Reform of Maker-Taker Pricing Model*, REUTERS (May 10, 2012), <http://www.reuters.com/article/sec-schumer-idUSL1E8GA7GS20120510>.

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

53. Larry Tabb, *The Grand Bargain: A Great Start, But Don't Hold Your Breath*, TABBFORUM (Jan. 6, 2015), <http://tabbforum.com/opinions/the-grand-bargain-a-great-start-butdon't-hold-your-breath>.

54. See 17 C.F.R. 242.610(c) (2017).

55. See, e.g., Robert Battalio, Shane A. Corwin, & Robert Jennings, *Can Brokers Have it All? On the Relation Between Make-Take Fees and Limit Order Execution Quality*, at 2 (Oct. 20, 2015) (unpublished manuscript), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2367462&download=yes](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2367462&download=yes).

56. See *U.S. Equity Market Structure: An Investor Perspective*, VIEWPOINT (BlackRock, New York, N.Y.), Apr. 2014, at 7, <https://www.blackrock.com/corporate/en-us/literature/whitepaper/viewpoint-us-equity-market-structure-april-2014.pdf> (“[T]he need for incentives and rebates is not the same across all stocks. Regulators should review whether highly liquid stocks require any rebates at all.”).

57. See Open Letter, BATS, *supra* note 51.

likewise considering a pilot program aimed at assessing the effect of maker-taker fees and their alternatives on certain stocks.<sup>58</sup>

Unfortunately, the BATS proposal substantially increases market complexity.<sup>59</sup> A recent study by the Royal Bank of Canada found that there already were 839 different fee schedules across U.S. exchanges.<sup>60</sup> Even assuming that regulators or exchanges could determine an optimal fee structure, a dynamic fee system demands vigilant monitoring by trading venues, which would be costly. Regardless of the cost, a dynamic system does not necessarily alleviate fears that certain HFT strategies will game these systems, causing periodic artificial drops in liquidity. Part of the problem stems from the breakneck rate at which market complexity increased, leaving regulators in the rearview mirror. At this stage, allowing exchanges to tier their fees would only complicate matters further.

Nonetheless, commentators have paid relatively little attention toward altering the maker-taker system during periods of high volatility and low liquidity. For example, this structure would allow exchanges to increase the size of these fees if trading activity trips a circuit breaker or exceeds a limit-up limit-down band.<sup>61</sup> If the maker rebates were high enough, they would incentivize HFTs to make markets instead of fleeing markets entirely. Although the configuration would still increase market complexity to some degree, exchanges would retain discretion about whether to activate the altered fees, meaning regulators would control the complexity instead of the other way around. Over time, as regulators and exchanges learn more about how HFT operates, they can set an optimal level of fees, harnessing HFT's benefits while minimizing its detrimental effects.

### C. Measures Addressing Market Stability Issues

To deal with issues related to market stability and systemic risk, regulators must focus their efforts on maintaining HFT's presence in the market, in good times and in bad. The market-making obligations and dynamic maker-taker fees discussed above would go a long way towards accomplishing this. Still, regulators must gather more details about how HFT

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58. *Regulatory Reforms to Improve Equity Market Structure: Hearing Before the S. Subcomm. on Sec., Ins. & Inv. of the S. Comm. on Banking, Hous. & Urban Affairs*, 114th Cong. 6 (2016) (Statement of Stephen Luparello, Dir., SEC Div. of Trading & Mkts) (indicating that the SEC would implement a maker-taker fee pilot program if its Equity Market Structure Advisory Committee recommended such action).

59. See *The Role of Regulation in Shaping Equity Market Structure and Electronic Trading: Hearing Before the S. Comm. on Banking, Hous. & Urban Affairs*, 113th Cong. 4-5 (2014) (Statement of Jeffrey Sprecher, CEO, Intercontinental Exch., Inc.) (stating that maker-taker pricing should be banned because it adds to market complexity).

60. See Nathaniel Popper, *Stock Exchange Prices Grow So Convolved Even Traders are Confused, Study Finds*, N.Y. TIMES DEALBOOK (Mar. 1, 2016), <https://www.nytimes.com/2016/03/02/business/dealbook/stock-exchange-prices-grow-so-convoluted-even-traders-are-confused-study-finds.html>.

61. Charles R. Korsmo, *High-Frequency Trading: A Regulatory Strategy*, 48 U. RICH. L. REV. 523, 608 (2014); Fox et al., *supra* note 3.

firms design their strategies and under what conditions they are most vulnerable to malfunctions. Regulators must also investigate ways in which they can manage HFT-induced market interdependence and correlations without unduly hampering the benefits of inter-exchange price competition.

The SEC has already taken several steps in this area, most notably by revamping single-stock circuit breakers<sup>62</sup> and instituting the Limit-Up Limit-Down Rule.<sup>63</sup> The SEC also passed Regulation Systems Compliance and Integrity (Reg. SCI) in 2014, imposing stringent compliance and monitoring requirements on most trading platforms.<sup>64</sup>

Observers like Professor Charles Korsmo place great faith in these measures' effectiveness, noting that circuit breakers and the limit-up limit-down mechanism "are the most straightforward way[s] to prevent a repeat of the major dislocations of the Flash Crash."<sup>65</sup> Similarly, Professors Fox, Golsten, and Rauterberg enthusiastically endorse both measures as "moderate proposals which should have salutary effects in moderating future crashes."<sup>66</sup>

Yet despite their apparently simple and uncontroversial nature, both measures have significant shortcomings. Circuit breakers are blunt tools that are artificially set and often too far-reaching.<sup>67</sup> The Limit-Up Limit-

62. Under these circuit breakers, trading in a given NMS stock is paused across U.S. equity markets for a five-minute period if that the stock experiences a significant price decline over the preceding five minutes (10%, 20%, or 30%, depending on the stock). *See* Order Granting Accelerated Approval to Proposed Rule Changes Relating to Trading Pauses Due to Extraordinary Market Volatility, Exchange Act Release No. 62,252, 98 SEC Docket 2160 (June 10, 2010). In 2012, the SEC altered the program by, among other things, decreasing the market decline thresholds and extending the length of the trading halt. *See* Order Approving the NMS Plan to Address Extraordinary Market Volatility, Exchange Act Release No. 67,091, 77 Fed. Reg. 33498, 33508-10 (June 6, 2012).

63. Under the rule, limit-up limit-down price bands are calculated (and recalculated at throughout the trading day) for each security at a percentage above and below the security's average price over the prior five minutes of trading. Trading cannot occur outside of these price bands. For more liquid stocks, the percentage level for the price band is five percent while the percentage level for most other stocks is 10%. The rule includes several exceptions, the most notable of which is the doubling these price bands during the opening and closing periods of the trading day. *See* FINRA Rules, at Rule 6190; NMS Plan to Address Extraordinary Market Volatility (as amended by SEC Approval Order, Exchange Act Release No. 77679) 11 (2016), <http://www.finra.org/sites/default/files/regulation-NMS-plan-to-address-extraordinary-market-volatility.pdf>.

64. 17 C.F.R. §§ 242.1000-07 (2017). Under the regulations, these trading venues must also promptly disclose technology problems to the SEC when they occur. Regulation SCI does not impact HFT directly but does force trading venues to more closely monitor HFT activity. *See* Regulation SCI Adopting Release, Exchange Act Release No. 73639, 79 Fed. Reg. 72252, 72410 (Dec. 5, 2014).

65. Korsmo, *supra* note 61.

66. *See* Fox, et al., *supra* note 3, at 272.

67. *See, e.g.,* Bradley Hope & Dan Strumpf, *The Problem With Circuit Breakers*, WALL ST. J. (Jan. 7, 2016), <https://www.wsj.com/articles/the-problem-with-circuit-breakers-1452205576>; Lee Chyen Yee & Samuel Shen, *China suspends market circuit breaker mechanism after stock market rout*, REUTERS (Jan. 7, 2016), <http://www.reuters.com/article/us-china->

Down Rule, meanwhile, has also exhibited significant shortcomings when faced with extreme market volatility.<sup>68</sup> In a 2014 speech, then-SEC Chair Mary Jo White acknowledged that technology had “transformed the nature of trading” such that regulators could only address the problems posed by modern trading practices through substantial regulatory efforts targeting market stability.<sup>69</sup> While accepting that HFT was an inevitable result of technological advancement, she stressed that the SEC was “assessing the extent to which specific elements of the computer-driven trading environment may be working against investors” and imposing systematic risks to secondary markets more generally.<sup>70</sup> In 2016, White gave an update on those SEC assessments, again highlighting the challenges associated with developing a regulatory response to “troubling” trading practices.<sup>71</sup> Indeed, HFT firms, with their large trading footprints, can uniquely affect broader secondary market activities both domestically and abroad. This section details several measures financial regulators can enact to manage these risks.

### 1. Anti-Disruptive Trading Rules

The SEC is currently considering an anti-disruptive trading rule that would “apply to active proprietary traders in short time periods when li-

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stocks-idUSKBN0UL1RC20160107 (describing China’s difficulties with successfully implementing stock circuit breakers); *see also* Memorandum from the Mkt. Quality Subcomm. to the Equity Mkt. Structure Advisory Comm. 2 (July 25, 2016) (<https://www.sec.gov/spotlight/emsac/emsac-market-quality-subcommittee-recomendation-072516.pdf>) (noting that had a market-wide circuit breaker been triggered during an acute incident of market stress, “it would have contributed to market chaos and selling pressure, thereby exacerbat[ing] the situation”).

68. On August 24, 2015, US markets fell sharply due to worries over economic troubles in China and other commodity-dependent emerging markets. Pre-market volatility levels were high. Ten minutes after the opening bell, nearly half of NYSE-listed equities had yet to begin trading. It was not until almost 10:00 AM that all S&P 500 securities opened. Wild price swings resulted, triggering nearly 1,300 trading halts as required by the Limit-Up Limit-Down bands. The trading halts caused so much disruption that market could not completely stabilize until well into the afternoon. *See Circuit Breakers and New Market Structure Realities*, STATE STREET GLOBAL ADVISORS (Jan. 13, 2016), <https://www.ssga.com/investment-topics/general-investing/2016/circuit-breakers-and-new-market-structure-realities.pdf>. The SEC’s Equity Market Structure Advisory Committee (EMSAC) issued a memorandum in the aftermath of this event, which acknowledged that the Limit-Up Limit-Down mechanism’s re-opening process “does not function well” and suffers from a “dearth of market participation.” To that end, the EMSAC recommended that the Limit-Up Limit-Down protocol be amended to allow for a more gradual re-opening process and include a “mean reversion” process that would “allow[ a stock] to trade back to its original price without triggering bands on the way back up.” *See* Memorandum, *supra* note 67.

69. White, *supra* note 2.

70. *Id.*

71. Mary Jo White, Chair, U.S. Sec. & Exch. Comm’n, Keynote Address at the Security Traders Association 83rd Annual Market Structures Conference: Equity Market Structure for 2016 and for the Future (Sept. 14, 2016), <https://www.sec.gov/news/speech/white-equity-market-structure-2016-09-14.html>.

quidity is most vulnerable and the risk of price disruption caused by aggressive short-term trading strategies is highest.”<sup>72</sup> Although the SEC has not released a formal rule proposal, former Chair White indicated the new rule would likely include “affirmative or negative trading obligations for high-frequency trading firms that employ the fastest, most sophisticated trading tools.”<sup>73</sup>

The rule might bear similarities to the CFTC’s anti-disruptive trading practices rule, which makes it unlawful in the futures and commodities space for any person to engage in any trading, practice, or conduct that (i) violates bids or offers; (ii) demonstrates an intentional or reckless disregard for the orderly execution of transactions during the closing period; or (iii) constitutes spoofing.<sup>74</sup> Exchanges have also experimented with anti-disruptive trading rules. For instance, the SEC recently approved a BATS-proposed rule prohibiting exchange members from engaging in or facilitating disruptive quoting and trading activity.<sup>75</sup> The rule built off the exchange’s existing anti-manipulation authority, but defined and prohibited disruptive trading with more specificity.<sup>76</sup> To that end, the rule also gives BATS more power to cut off-exchange access when a client engages in such activity.<sup>77</sup>

An anti-disruptive trading rule along the lines proposed would benefit market stability in several ways. Markets are often subject to extreme volatility, so a rule restricting aggressive HFT strategies from removing large amounts of liquidity during those times would dampen HFT’s amplificatory effect on severe market swings. But the rule will only be effective if it is targeted and well-defined. Regulators need to identify not only which activities are disruptive, but also “which traders should be restricted” and “during which time periods” these restrictions should apply.<sup>78</sup> Too broad a definition will capture legitimate activity, potentially chilling such trading and impeding HFT firms that can and want to provide liquidity to the market from doing so. On the other hand, too narrow a definition will

72. White, *supra* note 2.

73. *Id.* However, Stephen Luparello, the head of the SEC’s Trading and Markets division, suggested that the rule might instead resemble NYSE’s requirements for specialists, which impose an obligation to act as a liquidity provider of last resort. See Emmanuel Olaoye, *Anti-Disruptive Trading Rule Will Look Like Old Specialist Rules, Says Senior SEC Official*, COMPLIANCE COMPLETE (Oct. 3, 2014), <http://www.conatum.com/presscites/AntiDisruptive.pdf>.

74. 7 U.S.C. § 6c(a)(5) (2016).

75. Order Approving BATS Proposed Rule Changes Relating to Disruptive Quoting and Trading Activity, Exchange Act Release No. 77171, 81 Fed. Reg. 9017 (Feb. 18, 2016); *Rules of BATS BZX Exchange, Inc.*, BATS, at Rule 12.15, [http://cdn.batstrading.com/resources/regulation/rule\\_book/BATS\\_Exchange\\_Rulebook.pdf](http://cdn.batstrading.com/resources/regulation/rule_book/BATS_Exchange_Rulebook.pdf).

76. *Id.*

77. *Id.* at Rule 8.17.

78. *High Frequency Trading’s Impact on The Economy: Hearing Before the S. Subcomm. on Sec., Ins. & Inv. of the S. Comm. on Banking, Hous. & Urban Affairs*, 113th Cong. 34 (2014) (statement of Hal S. Scott, Dir., Comm. on Capital Markets Regulation).

prevent the SEC from evaluating the facts and circumstances of each case, an equally undesirable outcome. In response, then-Chair White claimed that the rule would be “tailored to apply to active proprietary traders” in short time periods.<sup>79</sup> Yet as other regulatory efforts have shown, these definitions are sometimes hard to pin down.<sup>80</sup>

As with other measures, successful implementation of an anti-disruptive trading rule depends on accurately parsing out the good HFT from the bad. The SEC’s ongoing data-driven approach to regulation, detailed more thoroughly below, should continue and help the agency define what constitutes disruptive trading, who does it, and when do they do it. To ensure a good rule, regulators must quantify disruptive trading and identify instances of it in market data. Despite the SEC’s best efforts, there will always be false positives. But if the SEC takes enough care in developing the rule and adjusting it going forward, detection and market stability should improve.

## 2. Order Message Limits

Many exchanges already limit the number of messages its members can send on a per second basis. Traders can submit four types of messages to an order book: to *add* a limit order, to *cancel* a limit order, to *cancel and replace* one limit order with another, and to place a *market order*.<sup>81</sup> HFT strategies often send hundreds of these messages every second, but a trading platform can limit the number of messages that a market participant can send to it by either rejecting messages sent in excess of the limit or cutting the market participant off completely.<sup>82</sup> Other exchanges have message pricing systems that impose further monetary penalties for excessive ordering.<sup>83</sup>

These “throttles,” when tripped, can aid in the rapid detection of malfunctioning algorithms while reducing the damage caused by manipulative algorithms, like quote stuffing strategies.<sup>84</sup> Throttles improve market stability in several ways: they protect the stability of a trading venue’s order

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79. See White, *supra* note 2.

80. See 12 U.S.C. § 1851(h)(4) (2016) (Volcker Rule definition of “proprietary trading”).

81. See David Kane, Andrew Liu & Khanh Nguyen, *Analyzing an Electronic Limit Order Book*, R. J., June 2011, at 64, 64.

82. For example, the Eurex exchange will automatically “throttle,” or cut off, messaging after a member sends 150 or more messages in a second and automatically disconnects the member entirely should messaging exceed 450 messages a second. Megan Morgan, *What’s the Best Way to Regulate HFT*, TABB FORUM (Feb. 12, 2014), <http://tabbforum.com/opinions/what’s-the-best-way-to-regulate-hft>.

83. Linton & O’Hara, *supra* note 42, at 24.

84. See Regulation Automated Trading, 80 Fed. Reg. 78823 (proposed Nov. 24, 2015); Supplemental Notice of Proposed Rulemaking, 81 Fed. Reg. 85334 (proposed Nov. 25, 2016) (to be codified at 17 C.F.R. pts. 1, 38, 40, 170); see also Concept Release on Risk Controls and System Safeguards for Automated Trading Environments, 78 Fed. Reg. 56542 (Sept. 12, 2013).

processing system, give these trading venues and market participants flexibility when responding to questionable trading patterns, and automatically cut off problematic trading activity before its effects spread to other trading platforms or asset classes. Throttles also represent a beacon of simplicity in a sea of complexity. Such limits apply to everyone, and can easily adapt to changing market conditions if designed correctly.

In the futures and commodities space, the CFTC recently proposed Regulation AT. Among other things, Regulation AT mandates that algorithmic traders and exchanges establish maximum message limits as part of its pre-trade risk control process.<sup>85</sup> The regulation does not set particular limits or thresholds, but rather gives traders and exchanges the discretion to set levels reasonably designed to prevent Algorithmic Trading Events, defined as either an algorithmic trading compliance issue or an algorithmic trading disruption.<sup>86</sup>

Regulators should apply this approach across all secondary markets. Allowing HFT firms to set their own message limits, ones informed by specific information including the strategy being employed and that system's speed, avoids the under or over-inclusiveness problems accompanying a strict message limit. Exchanges, meanwhile, can vary message limits as appropriate based on factors like the time of day, type of security, and current market conditions. More generally, shifting the supervisory onus onto algorithmic traders and exchanges should make them more sensitive to market stability issues, which in turn should encourage more dialogue between the industry and regulators and spurring cultures of compliance within HFT firms. Importantly, overall market complexity is unlikely to increase much; if anything, complexity might decrease as exchanges and market participants come to consensus about what the most appropriate message limits for particular types of strategies should be.

### 3. HFT Registration and Disclosure Requirements

The SEC recently proposed an amendment to Rule 15b9-1 that would call for many HFT firms to register with FINRA.<sup>87</sup> While many HFT firms are already subject to SEC oversight as brokers, the rule change would boost the SEC's ability to monitor for fraud across markets by expanding the number of firms subject to FINRA examinations and enforcement actions.<sup>88</sup>

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85. Regulation Automated Trading, 80 Fed. Reg. at 78852.

86. *Id.*

87. See Exemption for Certain Exchange Members, Exchange Act Release No. 74581, 80 Fed. Reg. 18036, 18038-39 (proposed Apr. 2, 2015) (to be codified at 17 C.F.R. pt. 240).

88. The proposed amendment would eliminate the *de minimis* allowance for off-exchange and proprietary trading, and would “replace it with a more targeted exemption from [FINRA] membership for a broker-dealer that conducts business on a national securities exchange” and trades off-exchange solely for hedging purposes. *Id.* at 18045-46.

The amendment's registration, reporting, and transparency objectives further important security and fairness goals.<sup>89</sup> These mechanisms convey important information about individual firms and systemic risk to regulators. Under a more comprehensive registration regime, regulators could identify those HFT strategies posing systemic risks with more certainty. Regulators could also isolate and investigate HFT firms contributing to severe market disruptions in a more cost and time-efficient way. Consequently, regulators would have the ability to implement necessary market infrastructure changes more quickly and effectively. Moreover, information regarding how and where these strategies operate as well as what securities they deal in will lead to a better mapping of secondary markets, giving regulators more insight into where these markets are most apt to transmit the effects of disruptive trading to other markets. Likewise, registration would increase the effectiveness of other proposed measures offered in this article, including on-demand auctions and order messaging limits.

Markets would likely also become more transparent. Under the proposed amendment, HFT firms would not need to join FINRA if they limit their trading to exchanges where they are members.<sup>90</sup> Thus, some firms could decide to stop their off-exchange trading while others opt to reduce such activity to curb the increased costs of trading that would result from FINRA membership.

While off-exchange trading undoubtedly has its benefits, including smaller bid-ask spreads and more market depth, the current proportions are too lopsided.<sup>91</sup> So much trading now happens away from exchanges that publicly quoted prices may no longer properly reflect a security's true price.<sup>92</sup> Given that Dark Pools and ECNs price their transactions based on the prices published by "lit" exchanges, inaccurate exchange prices also skew off-exchange pricing.<sup>93</sup> In short, more on-exchange trading will lead to more informed pricing that, all things equal, will make market prices more stable. In turn, because it is easier for companies to raise capital in

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89. *Id.* at 18070 (requiring an exempt dealer to comply with record retention requirements of 17 C.F.R. § 240.17a-4).

90. *Id.*

91. See Rhodri Preece, CFA INSTITUTE, DARK POOLS, INTERNALIZATION, AND EQUITY MARKET QUALITY 60-61 (2012); ORG. FOR ECON. CO-OPERATION & DEV., *Changing Business Models of Stock Exchanges and Stock Market Fragmentation*, in OECD BUSINESS AND FINANCE OUTLOOK 2016, at 120 (finding that, in 2015, 33% of all U.S. stock trades took were off-exchange, and 42% of all trades were in the form of "dark trading").

92. Public Statement of Louis E. Aguilar, Comm'r, SEC, U.S. Equity Market Structure: Making Our Markets Work Better for Investors, (May 11, 2015), <https://www.sec.gov/news/statement/us-equity-market-structure.html>. See also John McCrank, *Dark Markets May Be More Harmful Than High Frequency Trading*, REUTERS (Apr. 7, 2014), <http://www.reuters.com/article/us-markets-darkpools-analysis-idUSBREA3605M20140407>.

93. *Id.*

stable secondary markets, the cost of capital will fall, increasing efficiency.<sup>94</sup>

Amending Rule 15b9-1 is a useful first step, but the SEC should also consider incorporating aspects of similar, more detailed registration requirements pioneered by its foreign counterparts. For instance, the European Union's MiFID II proposal requires significant disclosures.<sup>95</sup> HFT firms must give their home state regulators descriptions of their algorithmic trading strategies, details of the trading parameters or limits to which the system is subject, and the key compliance and risk controls that it has in place.<sup>96</sup> Registered HFT firms and trading venues must also establish effective systems and risk controls to ensure trading systems are resilient and have enough capacity.<sup>97</sup> As part of these risk controls, senior management at HFT firms must designate a "responsible party" to sign off on the initial deployment or a substantial update to an algorithmic trading system or strategy.<sup>98</sup> The directive further mandates that firms test their algorithms to ensure they work as intended in stressed market conditions and, if necessary, be able to turn them off when the situation demands it.<sup>99</sup> In turn, trading venues that allow algorithmic trading need to perform due diligence and conformance testing on the users of its systems.<sup>100</sup>

Imposing more specific registration requirements is a path worth considering. The long-term effects of, for instance, requiring descriptions and periodic testing of algorithms alongside registration would improve market stability tremendously. HFT algorithms will become more resilient, and regulators more competent at supervising them. Of course, too stringent requirements might cause HFT firms to flee to less regulated trading platforms or jurisdictions. Coming up with conditions to test these algorithms will also, at least initially, be difficult and costly. Regulatory coordination and information sharing, however, can mitigate these concerns, discussed more thoroughly in Part II.

#### D. *Measures Addressing Investor Protection Issues*

Regulators must restore the public's faith that the secondary market protects their interests. First, regulators must make the secondary market more transparent. Investor protection concerns in the HFT context primarily revolve around opacity: only the most sophisticated investors know

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94. Nicholas Economides & Robert Schwartz, *Electronic Call Market Trading*, 21 J. PORTFOLIO MGMT., no. 3, 1995, at 10.

95. See MiFID II, *supra* note 40, at arts. 17, 48; *Commission Proposal for Regulatory Technical Standards on the Organisational Requirements of Investment Firms Engaged in Algorithmic Trading*, COM (2016) 4478 final (Aug, 19, 2016) [hereinafter RTS 6]; see also Katz & Lam, *supra* note 47.

96. MiFID II, at art. 17(2); RTS 6, at art. 28.

97. MiFID II, at art. 17(1).

98. RTS 6, at art. 5.

99. MiFID II, at art. 17; RTS 6, at arts. 6-10.

100. MiFID II, at art. 48.

the ins-and-outs of how HFT and trading dynamics work.<sup>101</sup> Second, regulators must assure investors that they can catch predatory HFT strategies in the act. To accomplish this, regulators must amplify their surveillance capabilities and aggressively pursue enforcement actions against manipulative HFT strategies. However, regulators must also make sure not to demonize HFT strategies that add value to secondary markets. As previously discussed, electronic trading developed, at least in part, to curb certain abusive practices of manual traders. Regulation must maintain HFT's competitive benefits. Finally, regulators must enhance the perceived fairness of secondary markets in the eyes of the public. Competitive pressure to increase order flow pushed trading venues to cater to HFT demands, creating what many perceived as a "two-tiered" market. Co-location, proprietary data feeds, and specialized order types all animate claims that the market is rigged.<sup>102</sup> Regulators should revisit each of these developments and determine if they actually serve the public interest.

Despite this, the SEC has taken several positive steps to make secondary markets more transparent and manageable. In 2011, the SEC passed the Large Trader Reporting Rule, imposing registration and reporting requirements on certain traders that exceed defined volume thresholds.<sup>103</sup> The rule allows the SEC to see how major traders interact with securities markets, reconstruct trading activity following periods of extreme market volatility, and apply the data gained from the reporting system for regulatory purposes going forward.

Similarly, in 2012 the SEC adopted Rule 613, requiring national securities exchanges and FINRA to submit plans to create, implement, and maintain a consolidated audit trail (CAT) designed to track the life cycle of all orders and trades.<sup>104</sup> Although exchanges report executed trades to the consolidated market data system, there is currently no database that logs records of all order activity, including canceled orders.<sup>105</sup> If the industry implements CAT on budget and regulators take steps to ensure the data given to it is accurate, it will allow regulators to track secondary mar-

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101. See generally Morelli, *supra* note 1, at 127-28.

102. See, e.g., MICHAEL LEWIS, *FLASHBOYS: A WALL STREET REVOLT* (2014); Laurie Carver, *Exchange Order Types Prompt Fears of HFT Conspiracy*, RISK MAG. (April 23, 2013), <http://www.risk.net/risk-magazine/feature/2261626/exchange-order-types-prompt-fears-of-hft-conspiracy>.

103. Large Trader Reporting Adopting Release, Exchange Act Release No. 64976, 76 Fed. Reg. 46960 (Aug. 3, 2011) (codified at 17 C.F.R. § 240.13h-1) (requiring registration by entities who trade either two million shares or \$20 million during any calendar day, or 20 million shares or \$200 million during any calendar month).

104. Consolidated Audit Trail Adopting Release, Exchange Act Release No. 67457, 77 Fed. Reg. 45722 (Aug. 1, 2012) (codified at 17 C.F.R. § 242.613).

105. Press Release, SEC, SEC Approves New Rule Requiring Consolidated Audit Trail to Monitor and Analyze Trading Activity (July 11, 2012), <http://www.sec.gov/News/PressRelease/Detail/PressRelease/1365171483188#.UkXTmMi30AM>.

ket activity more accurately and efficiently.<sup>106</sup> Of course, this is a big “if.”<sup>107</sup> Still, by creating a central repository of trading data, the SEC and other regulators can link customer account information to order event data and perform ongoing surveillance while also letting regulators complete market reconstructions. Equally important, CAT should enable more effective private enforcement, potentially giving private parties another tool with which they can reconstruct HFT manipulation to establish causation and intent in class action claims.<sup>108</sup>

Moreover, in 2013, the SEC established its Market Information Data Analytics System (MIDAS) as the agency’s official trade monitoring system.<sup>109</sup> MIDAS collects more than one billion records every day, and allows the agency to quickly reconstruct trading activity after extreme

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106. FINRA currently operates the Order Audit Trail System (OATS), an analogous system that tracks order and execution data for most U.S.-listed stocks. One recurring issue with the OATS system involves data integrity: the system is useful only to the extent that the data firms send it is accurate and complete. *See, e.g.* Matt Robinson & Sam Mamudi, *Goldman Fined \$1.8 Million by FINRA Over Inaccurate Trading Data*, BLOOMBERG (Jul. 27, 2015), <http://www.bloomberg.com/news/articles/2015-07-27/goldman-fined-1-8-million-by-finra-over-inaccurate-trading-data>.

107. In March 2016, Senator Michael Crapo of Idaho remarked that it was “beyond frustrating that six years after the Flash Crash we still haven’t built the CAT.” *Regulatory Reforms to Improve Equity Market Structure: Hearing Before the S. Subcomm. on Sec., Ins. & Inv. of the S. Comm. on Banking, Hous. & Urban Affairs*, 114th Cong. 3 (2016). However, in November 2016, the SEC finally approved a plan to implement CAT. In the approved plan, the SEC envisions a two-year implementation period. It also contemplates that both trading platforms and industry members will fund the system through tiered fixed fees based on messaging traffic. Estimates regarding CAT’s total costs ranged from \$30 million to \$91.6 million, with annual maintenance costs spanning from \$27 million to \$93 million (though many estimates also expected maintenance costs to be much higher than these figures in the first five years). *Ltd. Liab. Co. Agreement, CAT NMS, LLC* (Nov. 29, 2016), [http://www.catnmsplan.com/web/groups/catnms/@catnms/documents/appsupportdocs/cat\\_nms\\_plan\\_amended\\_to\\_include\\_miax\\_pearl\\_executed.pdf](http://www.catnmsplan.com/web/groups/catnms/@catnms/documents/appsupportdocs/cat_nms_plan_amended_to_include_miax_pearl_executed.pdf). These figures, however, ignore the costs borne by industry participants as they create internal systems to comply with their new CAT reporting obligations. *See* Dan Ryan, *Consolidated Audit Trail: The CAT’s Out of the Bag*, HARVARD L. SCH. FORUM ON CORP. GOVERNANCE & FIN. REGULATION (July 16, 2016), <https://corpgov.law.harvard.edu/2016/07/16/consolidated-audit-trail-the-cats-out-of-the-bag/>.

108. *See* Tara E. Levens, *Too Fast, Too Frequent? High-Frequency Trading and Securities Class Actions*, U. CHI. L. REV. 1511, 1526-55 (describing the securities-fraud class action framework as applied to HFT manipulation cases). For examples of prominent class actions in this area, *see* Complaint, *Providence v. BATS Global Markets, Inc.*, No. 14-2811 (S.D.N.Y. filed Apr. 18, 2014) (highlighting claims of manipulative and deceptive conduct in connection with HFT strategies, including electronic front running, spoofing, layering, and rebate arbitrage); Complaint, *Lanier v. BATS Exch., Inc.*, 105 F. Supp. 3d 353 (S.D.N.Y. 2015) *aff’d* 838 F.3d 139 (2d Cir. 2016) (dismissing complaint for failure to state a claim, holding that Regulation NMS obligates exchanges to *send* quote data to SIP no later than to direct feed subscribers, but does not require that direct feed and SIP subscribers *receive* data at same time).

109. Press Release, SEC, SEC Launches Market Structure and Data Analysis Website (Oct. 9, 2013), <https://www.sec.gov/News/PressRelease/Detail/PressRelease/1370539865> 877.

market events and detect troublesome or illegal trading behavior.<sup>110</sup> The SEC regularly posts visual summaries of this market data on its website, making markets seem less opaque to investors.<sup>111</sup>

The SEC has also made strides towards addressing the “two-tiered” market concern. In 2010, for example, the agency essentially prohibited “naked access”, which refers to the practice of an HFT firm paying an SEC-registered broker to directly access securities exchanges through their order management systems.<sup>112</sup> These systems had direct connections to exchanges and other trading platforms. By accessing these systems, HFT firms could reduce their trade latency and increase the efficacy of their trade strategies without submitting themselves to various risk-management and capital requirements faced by registered brokers. The Naked Access Rule prohibited broker-dealers from providing this access, and required brokers with market access to put in place risk management controls and supervisory procedures to help prevent erroneous orders, ensure compliance with regulatory requirements, and enforce pre-set credit or capital thresholds.<sup>113</sup>

Meanwhile, many of the SEC’s enforcement efforts have aimed to increase investor knowledge about how secondary markets work. For example, the SEC fined Direct Edge for selectively disclosing information about how a certain order type commonly used by HFT firms operated to its members.<sup>114</sup> In its enforcement action, the SEC indicated that many HFT firms gave Direct Edge input regarding how these orders should operate, and stated that Direct Edge should have informed its members of this fact.<sup>115</sup> In response, exchanges have taken steps to eliminate or simplify their order types, presumably to make their platforms seem less biased towards HFT traders.<sup>116</sup>

In short, the SEC has taken many positive steps towards developing a more robust market regulatory infrastructure. HFT registration will promote transparency while CAT, MIDAS, and similar programs will give the SEC dramatically better surveillance capabilities. Using these tools, the SEC can better parse the harmful algorithms from the beneficial ones and adjust their enforcement and policy focus accordingly. Though other juris-

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110. Frank Konkel, *SEC’s MIDAS program highlights how to do big data*, FCW (Mar. 28, 2014), <https://fcw.com/articles/2014/03/28/sec-midas-big-data.aspx>.

111. *Id.*

112. *See* Risk Management Controls for Brokers or Dealers with market Access, Exchange Act Release No. 34-63241, 75 Fed. Reg. 69791 (Nov. 3, 2010) (codified at 17 C.F.R. § 240.15c3-5).

113. *Id.*

114. EDGA Exchange, Exchange Act Release No. 74032, 2015 WL 137640 (Jan. 12, 2015).

115. *Id.*

116. *See, e.g.*, Adam Brown, *NYSE to Eliminate Several Complex Order Types to Rein in HFT*, IR MAG. (May 9, 2014), <http://www.irmagazine.com/articles/stock-exchanges-listings/20178/nyse-eliminate-several-complex-order-types-rein-hft/>.

dictions have placed more emphasis on investor protection issues,<sup>117</sup> there is no immediate need in the United States to follow suit beyond ensuring regulators implement and adhere to existing rules and proposals going forward. If anything, U.S. regulators should consider reevaluating trading platform co-location and proprietary data feed distribution practices in the medium-term. Any benefit gained from changing either of these things, however, would likely not come from equalized access to market data (HFT firms would simply place more emphasis on improving their order processing capabilities). Instead, eliminating these practices would help regulators dispel the public's perception, right or wrong, that markets are rigged.<sup>118</sup>

## II. THE IMPORTANCE OF REGULATORY COORDINATION

Every day, secondary markets grow faster, more complex, and more interconnected. HFT's ability to employ cross-exchange and cross-asset arbitrage strategies means that trading is more impactful on a global scale than ever before. Global securities regulations have grown more interdependent as well; issuers can cross-list their stocks on multiple exchanges while HFT firms often locate themselves and operate in multiple markets. Given HFT's constant demand for access to new trading opportunities, it is not surprising that exchanges have consolidated. Revenues from equities trading have plunged in the face of fierce competition, pushing stock exchanges to merge with derivatives and international exchanges to boost growth.<sup>119</sup> As one industry commentator opined, "[t]he way the market works is simple: if you're not in the top tier or in the second tier of [global] exchanges, you're finished."<sup>120</sup>

Regulators have taken notice of these trends. For instance, before the Flash Crash, single-security circuit breakers were limited to particular venues or assets. Once these circuit breakers were triggered, trading volume could nonetheless migrate off-exchange or to other assets. During the Flash Crash, CME, a derivatives exchange, hit many of these circuit breakers while NYSE did not. This meant that trading in certain derivatives halted, but trading in their associated stocks remained active. NYSE executed open trades, but later canceled and reversed them. However, orders

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117. In Australia, regulators partially shift the surveillance onus to other traders. Market participants must notify its primary market regulator, the Australian Securities and Investments Commission, if they have "reasonable grounds" to suspect that someone has placed an order or engaged in a transaction that creates or maintains an artificial, false, or misleading price. See Aust. Sec. & Inv. Comm'n, Regulatory Guide 238: Suspicious Activity Reporting 6 (Aug. 2013), <http://download.asic.gov.au/media/1247093/rg238.pdf>.

118. MICHAEL LEWIS, *FLASH BOYS* 109 (2014).

119. See Eyk Henning & Shayndi Raice, *NYSE Owner ICE, CME Group Mulling Bids for LSE*, WALL ST. J. (Mar. 1, 2016), <http://www.wsj.com/articles/nyse-owner-intercontinental-exchange-says-it-is-considering-offer-for-lse-1456821176>; Ken Sweet, *Why Stock Exchanges Have Merger Fever*, CNN MONEY (Feb. 18, 2011), [http://money.cnn.com/2011/02/18/markets/exchange\\_mergers/](http://money.cnn.com/2011/02/18/markets/exchange_mergers/).

120. See Sweet, *supra* note 119.

placed after trading resumed on CME, intended to hedge against their perceived stock losses on NYSE, did execute.<sup>121</sup> Paradoxically, these hedge trades lost money. Had both exchanges been subject to the circuit breakers, this state of affairs would not have taken place. Afterward, regulators revamped the circuit breaker system, and securities and futures exchanges must now follow procedures for coordinated market-wide trading halts based on declines in the S&P 500 index.<sup>122</sup> To facilitate more measures like these, the CFTC and SEC formed a Joint Advisory Committee to consider potential coordinated regulatory responses.<sup>123</sup> Both of the agencies have either taken up or considered many of the committee's recommendations.<sup>124</sup>

Likewise, successful implementation of most policy measures discussed in this article depends on significant regulatory coordination and cooperation. Rolling out on-demand batch auctions, for instance, requires regulators and exchanges to work together to determine eligible securities and traders. Altering tick sizes, maker-taker fees, and order message limits pose similar challenges. And with respect to surveillance tools like CAT, the SEC needs to collaborate with FINRA, broker-dealers, and traders to ensure the data collected is the data desired. Simply put, exchanges, regulators, and traders all need to work together on an ongoing basis to ensure these measures actually, and not just theoretically, improve market conditions.

Cooperation must extend to the international level as well. Inadequate coordination could result in HFT firms pursuing yet another arbitrage strategy, but this time of the regulatory variety. Downward competitive pressure from jurisdictions that want to attract or retain HFT's order flows might "enhance or debilitate [the] regulatory regime[s]" of other jurisdictions, putting certain investment activity that has profound effects on a given market beyond a state's regulatory reach.<sup>125</sup>

These risks are most acute with respect to financial transaction taxes. Even if these taxes are targeted and limited to aggressive trading strategies, HFT firms could simply avoid the tax by relocating their operations to another exchange in another jurisdiction. For instance, when Sweden began taxing financial transactions in the 1980s, bond trading fell by 85%

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121. Ananth Madhavan, *Exchange-Traded Funds, Market Structure, and the Flash Crash*, 68 FIN. ANALYSTS J., no. 4, 2012, at 20, 22.

122. SEC, Investor Bulletin: Measures to Address Market Volatility (Jan. 4, 2016), <https://www.sec.gov/investor/alerts/circuitbreakersbulletin.htm>.

123. JOINT CFTC-SEC ADVISORY COMM. ON EMERGING REGULATORY ISSUES, RECOMMENDATIONS REGARDING REGULATORY RESPONSES TO THE MARKET EVENTS OF MAY 6, 2010, at 2 (2010).

124. *Id.* at 3-14.

125. Amir N. Licht, *Regulatory Arbitrage for Real: International Securities Regulation in a World of Interacting Securities Markets*, 38 VA. J. INT'L L. 563, 606-07 (1998).

and futures trading fell by 98%.<sup>126</sup> By 1990, more than 50% of all Swedish trading moved to London. More recently, Italy's financial transaction tax caused trading in Italian stocks to fall by 34.2% the year it introduced the tax.<sup>127</sup> While the Italian government expected to raise \_1 billion via the tax, actual receipts totaled only \_200 million.<sup>128</sup> Italian traders have felt the effects: studies have found that volatility and bid-ask spreads significantly increased.<sup>129</sup>

Regulators must carefully think through HFT registration requirements and market-making obligations for similar reasons. If not implemented in a coordinated way, these requirements risk alienating both good and bad HFT, pushing both types to jurisdictions with more lenient regulations and less probing registration requirements.<sup>130</sup>

Of course, regulatory coordination is not always easy or desirable. Harmonizing HFT regulation on a global scale would be contentious and likely impractical. First, trying to universalize substantive regulation "can quickly devolve into regulatory nationalism as internal political and economic interests clash with international expectations."<sup>131</sup> Coordination may also exacerbate transparency, accountability, and legitimacy issues to the extent that international bodies not accountable to the subjects of the regulation develop universal regulatory principles.<sup>132</sup> Second, market structures can vary dramatically across jurisdictions. Rules established in a country with a single trading venue, for instance, should not be the same as those used in countries with highly fragmented markets.<sup>133</sup> Third, har-

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126. *Financial Transaction Taxes are Historically Harmful and Unsuccessful*, MODERN MARKETS INITIATIVE, <https://modernmarketsinitiative.org/topics/ftt/> (last visited Mar. 11, 2016).

127. *FTT Drags Down Italian Stock Trading Volumes*, FTSE GLOBAL MARKETS (Apr. 23, 2014), <http://www.ftseglobalmarkets.com/news/ftt-drags-down-italian-stock-trading-volumes.html>.

128. Maria Coelho, *Dodging Robin Hood: Responses to France and Italy's Financial Transaction Taxes*, 31 (Nov. 3, 2015) (unpublished Ph.D. dissertation, University of California at Berkeley), [http://www.sbs.ox.ac.uk/sites/default/files/Business\\_Taxation/Events/conferences/doctoral\\_meeting/2014/coelho.pdf](http://www.sbs.ox.ac.uk/sites/default/files/Business_Taxation/Events/conferences/doctoral_meeting/2014/coelho.pdf).

129. See Tobias Ruhl & Michael Stein, *The Impact of Financial Transaction Taxes: Evidence from Italy*, 34 *ECON. BULLETIN* 25, 32 (2014).

130. See Carol L. Clark, *Controlling Risk in a Lightning-Speed Trading Environment*, CHICAGO FED LETTER, no. 272, March 2010, <https://www.chicagofed.org/publications/chicago-fed-letter/2010/march-272>. Several major U.S. HFT players have expanded their operations to Europe, attracted by diverse trading opportunities, favorable corporate tax rates, and convenient regulatory requirements. Fiona Reddan, *Market Trading in a Flash*, IRISH TIMES (Oct. 2, 2009), <http://www.irishtimes.com/business/market-trading-in-a-flash-1.749197>.

131. Annelise Riles, *Managing Regulatory Arbitrage: A Conflict of Laws Approach*, 47 *CORNELL INT'L L. J.* 63, 66 (2014).

132. Kathleen Casey, Comm'r, SEC, *The Role of International Regulatory Cooperation and Coordination in Promoting Efficient Capital Markets*, Address Before the Instituto Bruno Leoni (June 12, 2010).

133. For example, the U.S. has 13 recognized exchanges and over 50 alternative trading systems. In contrast, 90% of trading activity in Japan occurs on the Tokyo Stock Exchange. See Yuji Nakamura & Toshiro Hasegawa, *Humans Lose Out as Robots Take Tokyo Stock*

monization efforts could create new arbitrage opportunities. Since the pace of enacting legal change will vary across countries, things might get worse before they possibly get better. Finally, uniform regulations risk the converse problem of regulatory arbitrage since they could potentially inhibit regulatory competition and experimentation, leading to stale and inflexible rules that quickly become outdated.

Even after acknowledging these limits, there is room for at least some level of international coordination. Given the interconnectedness of markets, international securities regulators should consider (1) coordinating their data-gathering and registration processes to better understand how HFT strategies impact investors and global markets; (2) sharing this data to enable quick and effective resolution of cross-border enforcement issues and inform more consistent, high-quality regulations that minimize potential regulatory gaps; and (3) undertaking synchronized responses to severe secondary market disruptions which promote cross-market stability and reduce systemic risk.

#### CONCLUSION

Contrary to public opinion, HFT is not a recent phenomenon. Electronic trading has been a fixture in markets since the 1960s, and HFT is simply its latest incarnation. Electronic trading arose out of a need to enhance secondary markets. In many ways, it has—trading opportunities are more diverse, spreads are lower, and price competition is at an all-time high. HFT, if properly managed, can propel these enhancements even further. Although HFT presents many logistical problems and poses significant philosophical challenges to past market paradigms, it can still be a force for good if utilized the right way.