Technology Innovations in Securities Trading: Can SEBI's Bicycle Catch the High-Frequency Trading Ferrari

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Abstract: Algorithmic high-frequency trading is a tech-innovation of securities trading. It is enabled by high-tech trading algorithms and communication and computing infrastructure that allows traders to profit based on the speed and volume of their trading, rather than by trading based on conventional trading fundamentals. However, its strategies have become ubiquitous with market manipulation, regulatory arbitrage and clouding the ability of investors to accurately read the market. Understandably, regulators have been making efforts to protect the markets and stay abreast with the rapid evolution of high-frequency trading.

In this endeavour, the U.K. Financial Services Authority remarked that regulators are riding bicycles to chase down the high-frequency trading Ferrari. Further, this Ferrari seems to constantly change its license-plate, routes and appearance. This has complicated efforts to prescribe preventive measures and seems to have resulted in a disproportionate reliance on post-facto remedial measures. In this light, this Article evaluates SEBI's proposals in its recent discussion paper on algorithmic trading and proposes certain measures to strengthen SEBI's regulatory framework.[1]

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1 See John Bates, *Algorithmic Trading and High Frequency Trading: Experiences from the Market and Thoughts on Regulatory Requirements*, Meeting of the Technical Advisory Committee, Commodity Futures Trading Commission [CFTC], (Technological Trading in the Markets) (July 14, 2010), http://www.cftc.gov/idc/groups/public/@newsroom/documents/file/tac_071410_binder.pdf.

I. Introduction

> "*Social uselessness - It's hard to imagine a better illustration than high frequency trading. The stock market is supposed to allocate capital to its most productive uses, for example, by helping companies with good ideas raise money. But it's hard to see how traders who place their orders one-thirtieth of a second faster than anyone else do anything to improve that social function.*"[2]
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> —P. Krugman

The function of technological development is to reduce human inefficiency and to make human life easier. In the securities markets, this function translates into increasing market efficiency and enabling easier and faster trading, by bypassing human limitations. High-frequency Trading ("**HFT**") is a manifestation of this function, which has catalyzed a tech-(r)evolution of the securities markets by allowing traders to profit from trading milliseconds before others, instead of requiring them to make informed trading decisions. In theory, if made milliseconds before a slightly worse trade, even a bad trade can make money for a high-frequency trader ("**HF Trader**"). This has the potential to obfuscate investment principles and divert capital markets from business-based value creation. This can cloud the view of the markets, to the point where investors cannot be certain whether they are looking at the market or an HFT mirage.

This mirage is best explained with reference to an anecdote from Flash Boys, an exposé on HFT; in 2007, Bradley Katsuyama, a trader with the Royal Bank of Canada (RBC) tried to execute trades based on price quotes displayed on their computer screens. However, as soon as he would place orders, the prices would change and he would end up buying or selling at a worse price than what was shown on the screen. This was happening to other RBC traders as well. Eventually, the Bradley realized that the prices on his screen were changing in reaction to his orders, before they could be executed into trades. This is because HF Traders were fast enough to react to these orders and race ahead with better-priced orders of their own, at a better price.[3]

Unsurprisingly, HFT's technological prowess has allowed it to dominate the Indian securities market. From 2011-12 to 2015-16, the percentage of

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[2] Paul Krugman, *Rewarding Bad Actors,* The Opinion Pages, Aug. 2, 2009, http://www.nytimes.com/2009/08/03/opinion/03krugman.html?_r=2. P. Krugman won the Nobel Memorial Prize for Economic Sciences in 2008.

[3] Michael Lewis, Flash Boys: A Wall Street Revolt (W.W. Norton & Company 2014) [Lewis].

HFT orders in India increased from 65% to 94% in cash equity and from 78% to 98% in equity derivatives.[4] Following this growth, SEBI has been incrementally regulating HFT through circulars, in exercise of its powers to protect the interests of securities investors and markets.[5] However, in my view, the extant regulatory framework is disproportionately reliant on post-facto remedial measures and does not inspire confidence. In fact, SEBI itself admitted last year that it cannot stop all instances of manipulative HFT.[6] Accordingly, on the back of the examination by various securities markets and regulators of proposals to contain and regulate HFT, SEBI issued a Discussion paper on '*Strengthening of the Regulatory framework for Algorithmic Trading & Co-location*' ("**Discussion Paper**"), soliciting comments from Indian market participants on proposed changes to the extant regulatory framework.[7]

This Article is a critique of the Discussion Paper. Part II of this Article contains a prefatory description of the key features and characteristics of HFT. Part III discusses and evaluates SEBI's current regulatory approach and framework, including a section on co-location, a key feature of HFT. Part IV evaluates SEBI's proposals proposed by SEBI in the Discussion Paper and other measures that may be considered in place of, or in tandem with, SEBI's proposals. Part V addresses a fundamental concern that touches upon the current market structure of Indian stock exchanges, arising out of such exchanges being self-regulatory delegatees of SEBI's regulatory responsibilities. Part VI contains findings and recommendations with regard to the proposals discussed in Part V. In Part VII, I conclude that SEBI should carry out a pre-emptive upgrade of its HFT rules, which must be flexible enough to react to arbitrage, but must always be grounded on India focused and comprehensive economic research.

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4 Jayshree Upadhyay and Sachin Mampatta, *Sebi looking at ways to limit algo trading, co-location benefits*, LiveMint:Money (Apr. 13 2016), http://www.livemint.com/Money/fK2Uiuoal9lzOuTFP2E7DK/Sebi-looking-at-ways-to-limit-algo-trading-colocation-bene.html.

5 §11(1), Securities and Exchange Board of India Act, 1992.

6 *Sebi to take stern action on algorithm trades misuse, says chairman U.K. Sinha*, Business Today (Jul. 30, 2015), http://www.businesstoday.in/markets/stocks/sebi-to-take-stern-action-on-algo-trades-misuse-chairman/story/222241.html.

7 SEBI, *Discussion paper on 'Strengthening of the Regulatory framework for Algorithmic Trading & Co-location'*, Aug. 5, 2016, http://www.sebi.gov.in/cms/sebi_data/attachdocs/1470393485587.pdf. [Discussion Paper]

II. Understanding High-Frequency Trading

Algorithmic trading is a method of trading securities on stock exchanges using computer algorithms, without human direction or control. It was first defined by SEBI in 2012 to mean generation of orders by using automated execution logic.[8] A more descriptive definition was proposed by the U.S. Commodity Future Trading Commission ("**CFTC**"), which is expressed in processual terms and traces the life cycle of a trade from preliminary decision-making to post-submission order management, as trading:

- Where algorithms determine whether to initiate, modify, or cancel an order, or makes other determinations with respect to an order such as relating to the target security, the market where the order will be placed, the order type, timing, sequencing, price, quantity of the order, etc.;
- electronic submission of such order for processing to the concerned market; and
- post-order submission management.[9]

HFT is a sub-set of algorithmic trading, where trading is implemented in large volumes within a short period of time.[10] It developed due to the securities markets observing the first-in-time rule, which allows trading in milliseconds to matter.[11] This rule means that at the same price, time-priority

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[8] SEBI Circular dated March 30, 2012 bearing Ref. No. CIR/MRD/DP09/2012 [March 30, 2012 Circular].

[9] Algorithmic trading is trading where algorithms automatically, or with limited human direction, decide whether to initiate orders and make decisions relating to timing, price, quantity and post-submission order management; *See* CFTC, *Q & A – Notice of Proposed Rulemaking on Regulation Automated Trading ("Regulation AT")*, Office of Public Affairs, (Proposed §1.3(ssss)), November 24, 2015 www.cftc.gov; [CFTC Q&A]; *See also* §4.1.(39), (40) Directive 2014/65/E.U, European Union, 15 May 2014 on markets in financial instruments [MiFID II]; This must involve computerized decision-making processes and not merely a system which only routes, confirms or processes executed orders. It is generally characterized by infrastructural attempts to minimize latency, avoiding human intervention and high intraday message rates in form of orders, quotes or cancellations; *See* Bundesanstalt für Finanzdienstleistungsaufsicht, *Translation of the main provisions of the High Frequency Trading Act (Hochfrequenzhandelsgesetz)*, Jan. 8, 2014, http://www.bafin.de/SharedDocs/Aufsichtsrecht/EN/Gesetz/hft_en.html [HFTA].

[10] For example, in October 2008, one HF Trader traded over 2 billion shares in one single day, accounting for over 10% of U.S. equity trading volume on that trading day; *See* Carol L. Clark, *Controlling risk in a lightning-speed trading environment*, Federal Reserve Bank of Chicago Financial Markets Group, Policy Discussion Paper Series PDP 1 (2010), https://www.chicagofed.org/publications/policy-discussion-papers/2010/pdp-1.

[11] Frank Pasquale, *Law's Acceleration of Finance: Redefining the Problem of High-Frequency Trading*, 36 Cardozo Law Review 2088, 2089 n. 15, (2015), http://www.cardozolawreview.com/content/36-6/PASQUALE.36.6.pdf.

determines which order should be executed. HF Traders exploit this rule by using their ultra-fast trading systems. But how fast is fast? Measuring HFT speed against human time horizon – the blink of an eye, shows that it is possible for a trader to issue roughly 400,000 trades in the blink of an eye:

Sr. No.	Description	Time Taken (Seconds)	Time Taken (Nanoseconds)
	The blink of an eye[1]	0.3	300,000,000
	Preparing an algorithmic trade.[2]	0.000,000,74	740
Number of Trades in the blink of an eye: 300,000,000 = 405, 405.41 Trades 740 = 1.2 Million Trades per Second (approx.)			

1 William Briggs, *How long is A 'Blink of an Eye' astronomically?* (William M. Briggs Oct. 24, 2010), http://wmbriggs.com/post/1750/.

2 Brendan Conway, *Wall streets need for trading speed: The Nanosecond age* (Wall Street Journal), http://blogs.wsj.com/marketbeat/2011/06/14/wall-streets-need-for-trading-speed-the-nanosecond-age/.

The speed of communicating these orders is key. HF Traders look to have low 'latency' i.e. the time-taken to transmit an order from the HF Trader's server to the markets servers (which match buy and sell orders). Each millisecond of reduced latency is worth over USD100 million.[12] This resulted in exchanges permitting co-location, which as the name suggests, refers to the system of stock exchanges allowing algorithmic traders to set-up their I.T. servers within the premises of the stock exchanges. In India, the Bombay Stock Exchange ("**BSE**"), National Stock Exchange ("**NSE**") and the MCX Stock Exchange offer co-location racks in their server rooms on lease to traders.[13] This is done to get as close as possible to the trade-matching servers of the stock exchange and achieve a speed advantage in data-transmission. This is system is quite controversial and a lot of criticism of HFT is linked to strategies enabled by this system.

Given that HFT implements speed-based strategies rather than investment-based value creation, its strategies are generally implemented from day-to-day, with the goal of achieving a flat net position overnight (where the buying and selling of positions offset each other and the HF Trader has no

12 Ciamac Moallemi and Mehmet Saglam, *The Cost of Latency in High-Frequency Trading*, 2 n.4 (February 5, 2013), http://ssrn.com/abstract=1571935.

13 Similarly, exchanges in other countries such as the Tokyo Stock Exchange, London Stock Exchange, New York Stock Exchange, etc., offer co-location to their stock brokers; *See* SEBI, *Discussion paper on Co-location/ Proximity hosting facility offered by the stock exchanges*, http://www.sebi.gov.in/cms/sebi_data/attachdocs/1367581007462.pdf.

un-hedged positions).[14] However, defining HFT is not easy as the term is *ex facie* precise, but actually covers a large and diverse set of constantly evolving strategies.[15] Ostensibly, this is why some regulators have defined HFT inclusively with reference to its characteristics, discussed above.[16] A ring-fenced definition could allow regulatory arbitrage, especially since traders are constantly evolving their strategies and algorithms to stay ahead of the regulators.[17] For example, Athena Capital LLC tweaked '*Gravy*', its trading algorithm to knowingly manipulate the NASDAQ in the last few seconds of trading days in 2009, by placing orders which they had no intention of fulfilling and then cancelling them soon thereafter.[18] Knowing very well that Gravy was violating U.S. securities law, Athena Capital internally discussed that they should modify and contain their trading strategies appropriately, so that they do not '*kill the golden goose*'. This was caught by the Securities Exchange Commission (SEC) and Athena Capital was sanctioned for a sum of one million U.S. dollars.[19]

Seemingly to avoid ring-fencing HFT, SEBI did not define HFT separately from algorithmic trading.[20] However, SEBI prescribed HFT targeted regulations, discussed in Part III below. These are generally motive-agnostic and quantitative in approach (for example, SEBI imposes a penalty on trading in excess of prescribed order-to-trade thresholds), based on the assumption that

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[14] SEC, *Concept Release on Equity Market Structure*, 17 CFR PART 242 Release No. 34-61358; File No. S7-02-10 (Jan. 14, 2010) at 45, https://www.sec.gov/rules/concept/2010/34-61358.pdf.

[15] O'Hara, *High Frequency Market Microstructure*, at 4 (April 2014), http://www2.warwick.ac.uk/fac/soc/wbs/subjects/finance/fof2014/programme/Maureen_ohara.pdf

[16] *Supra* note 9. The Securities Exchange Commission (SEC) has also identified similar characteristics of HFT, such as high-tech infra, programs, co-location, access to data feeds, minimized latency, frequent cancellations, reversals in positions and the goal of a flat-close of the trading day. *See* SEC Release *supra* note 16, at 45.

[17] On average, algorithms last only a few days before they need to be replaced; *See* Tor Brunzell, *High-Frequency Trading—To Regulate or not to Regulate - That is the Question*, 2:1 J.B.F.A. 3, 2013, http://www.omicsgroup.org/journals/high-frequency-trading-to-regulate-ozyr-not-to-regulate-that-is-the%20question-does-scientific-data-offer-an-answer-2167-0234.1000e121.pdf.

[18] *In the Matter of Athena Capital Research, LLC*. Administrative Proceeding File No. 3-16199 Release No. 73369/ October 16, 2014 at ¶8, 11, 23. *See also* In the Matter of Hold Brothers On-Line Investment Services, LLC *et al* Administrative Proceeding File No. 3-5046 Release No. 67924/September 25, 2012 at ¶32.

[19] *Id*. at ¶11, 54. *See also* ¶30, 35 [when Athena's trading strategies were successful, Athena described this in internal emails as "*dominating the auction*", "*owning the game*", "*Looks like we have some Mach chips….going to Vegas tonight….*"]. *See also* ¶39 [A marketing officer informed Athena Capital's CTO that he was concerned that the firms trading strategies were "*punching the stock*." This prompted Athena to cease email exchanges with respect to Athena's trading strategies on Athena's email servers and to use certain search terms to research Athena's trading "*at home, not here*."]

[20] The CFTC did this consciously and sought to extend its proposed regulatory framework (Regulation AT) equally to all algorithmic traders; *See* CFCT Q&A at 12.

breaches are unwanted, even where traders employ *bona fide* and legitimate trading strategies. Such an approach is cautious and appropriate, until SEBI tightens its regulatory framework. When it does do so, it may consider defining HFT with respect to, and by underscoring, its true motive (i.e. to profit from speed-based trading). This would allow SEBI to differentiate between legitimate and fraudulent or manipulative HFT on a qualitative basis.

Currently, SEBI has the power to regulate HFT on a qualitative "*smell test*" basis under the SEBI (Prohibition of Fraudulent and Unfair Trade Practices relating to Securities Market) Regulations, 2003 ("**PFUTP Regulations**"). These regulations generally prohibit and regulate fraudulent and manipulative HFT practices, which could include HFT activities, even if they do not violate SEBI's quantitative provisions.[21] For example, the PFUTP Regulations prohibit activities such as:

- creating false or misleading appearances of trading or entering into a securities transaction without the intention to complete it;
- dealing in securities in a manner which inflates, depresses or causes price fluctuations and price manipulation;
- using or employing manipulative, deceptive or fraudulent devices, schemes or artifices, etc.[22]

While these regulations clarify that the list of fraudulent and unfair practices is not intended to be exhaustive, SEBI may consider specifically prohibiting HFT specific activities, such as activities which:

- are unnecessarily aggressive or disruptive (including order cancellations);
- over-load or destabilize systems or which initiates or exacerbates market trends;
- create pricing illusions or obscure identification of genuine orders;[23]

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[21] For example, HF Traders can rapidly place large volumes of rapid-fire orders to overload market systems to slow down other traders or ignite market trends. *See* John McPartland, *Recommendations for Equitable Allocation of Trades in High Frequency Trading Environments*, (Revised July 2014), https://www.chicagofed.org/publications/policy-discussion-papers/2013/pdp-1. [At 7- 9, McPartland describes the HFT strategies of '*spoofing*', '*layering*' and '*quote-stuffing*'.] In this regard, it is reported that 96% of orders submitted to the U.S. markets are not executed and may not be *bona fide* Dave Michaels, *Wall Street to Get Graded on How Much Spoofing It's Facilitating*, Bloomberg, January 5, 2016, http://www.bloomberg.com/news/articles/2016-01-05/wall-street-to-get-graded-on-how-much-spoofing-it-s-facilitating.

[22] *See* §3, §4(2) r/w §2(1)(b), 2(1)(c), PFUTP Regulations.

[23] A similar prohibition is contained in the E.U. Market Abuse Directive II; For the text of the E.U. MAD II, *see* http://ec.europa.eu/finance/securities/abuse/index_en.htm.

- or where traders enter orders on one side of the buy-sell equation with the knowledge that a similar order on the other side of the equation will be placed, etc.[24]

Wherever required, the PFUTP Regulations qualify the above provisions with words like '*unnecessarily aggressive*' or '*disruptive*' to provide built-in safeguards for HF Traders to prove the legitimacy of their strategies in legal actions. Additionally, SEBI may consider prefacing these clauses with the words "*unless the contrary is established*" to clarify that these criteria are rebuttable.

III. Regulatory Approach & Framework

Knowing what we know about HFT (or rather, what we do not), allowing HFT to be unregulated or to completely ban HFT would not be advisable. Instead, a suitable regulatory blend of mandatory requirements and *post facto* enforcement should be adopted, which reduces risk exposure without unnecessarily impeding tech-advancement.

Currently, SEBI regulates HFT through circulars and liability regulations.[25] The first move in this regard was a circular in March 2012 which introduced broad guidelines for algorithmic trading.[26] This was after admitting earlier that month, that neither SEBI nor the exchanges were capable of handling HFT.[27] These broad guidelines were supplemented by later guidelines and circulars, issued by SEBI from time to time, and currently, provide for the following:

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[24] *See* FINRA Manual, Rule 6140 - Other Trading Practices, http://finra.complinet.com/en/display/display_main.html?rbid=2403&element_id=4322.

[25] *See* SEBI (Prohibition of Fraudulent and Unfair Trade Practices relating to Securities Market) Regulations, 2003.

[26] March 30, 2012 Circular *supra* note 8. SEBI allowed algorithmic trading in 2008 when it allowed direct market access (DMA) to institutional investors, without manual intervention but through broker systems; *See* Anuradha Guru and Rasmeet Kohli, *Direct Market Access: New Kid on the block*, NSE Newsletter Aug. 2009, http://www.nseindia.com/content/press/aug2009_2.pdf; QuantInsti, *Algorithmic trading in India: History, regulations and future*, Industry Regulations and New Developments (Jun. 10, 2015), http://www.quantinsti.com/blog/algorithmic-trading-india/.

[27] *See* Mobis Philipose, *SEBI should study the impact of algorithmic trading before taming it* (Dec. 2012), http://www.livemint.com/Opinion/LmtMQAa8sM4pVZ65XJq2ZO/Sebi-should-study-the-impact-of-algorithmic-trading-before-t.html.

A. Co-location

Co-location (discussed in Part II above) should be effectively available to all, on a uniform and non-discriminatory basis. This has been emphasized by the U.S. Securities and Exchange Commission ("**SEC**"),[28] CFTC[29] and the IOSCO.[30] In this regard, SEBI provides that exchanges must, in order to ensure fair and equitable access to co-location facilities, provides that exchanges must:

- ensure that sufficient rack space is available for all traders who wish to co-locate;
- disseminate information relating to co-located orders, trades, latency and charges, for the purpose of transparency;[31]
- ensure fair, transparent and equitable access to exchange facilities and data feeds to all co-locaters and similar latency to all co-locaters *inter se*.

However, it remains possible to have different data feeds for co-locaters, non-co-locaters and the public. This was a problem in the U.S. where data feeds for co-located traders also contained enriched data, including data relating to cancellations, modifications and executions and revealed the identity, origin, time-stamps of orders, *etc*. HF Traders can use such enriched data to game the system and trade ahead of investors who rely on public feeds to make informed trading decisions.[32] Some exchanges have given preferential access to data to HFT firms, while data-transmission to the public was delayed.[33] Similar concerns exist in India as well, for example,

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[28] *See* SEC Concept Release *supra* note 9, at ¶58. This is required under §6(5) of the U.S. Securities Exchange Act, 1934, which requires that exchange rules should not be designed to permit unfair discrimination in the markets.

[29] *See* CFTC, *Co-Location/Proximity Hosting Services Proposed Rules*, 33198, Federal Register Vol. 75, No. 112, June 11, 2010, http://www.cftc.gov/idc/groups/public/@lrfederalregister/documents/file/2010-13613a.pdf.

[30] *See* SEBI Discussion Paper *supra* note 7; IOSCO, *Regulatory Issues Raised by the Impact of Technological Changes on Market Integrity and Efficiency*, Consultation Report (CR02/July 2011) at 28, http://www.iosco.org/library/pubdocs/pdf/IOSCOPD354.pdf.

[31] *See* SEBI Circular dated May 13, 2015 bearing Ref. No. CIR/MRD/DP/07/2015.

[32] *See* McPartland *supra* note 23 at 21, 23-25, 31.

[33] *In the Matter of New York Stock Exchange LLC, and NYSE Euronext*, Administrative Proceeding File No. 3-15023; The NYSE was held to have violated a rule that requires data to be distributed on fair, reasonable and not unreasonably discriminatory terms and which prohibits exchanges from releasing data through proprietary feeds before such data is sent for inclusion in the consolidated feeds [Rule 603(a) of Regulation NMS]. *See also Lanier* v. *BATS Exchange, Inc*., *et al*., 14-CV-3745 (May 23, 2014).

last year, a whistleblower claimed that the NSE is/ has given algorithmic traders inside information.[34]

In this light, I recommend that:

- Data feeds should be equitably disseminated to co-located traders, non-co-located traders and the public. This is an important lesson to be learned from the U.S. which, due to a lacuna in its regulations, allowed HF Traders to get a sneak-peek at the U.S. markets.[35] Such differentials in data feeds should be eliminated. The information in all data feeds should the same, be given at the same time and from the same source, with full transparency. Thereafter, co-locaters can be left free to exploit speed-advantages in data processing and communication to the exchanges. This will balance public policy with the interests of HF Traders as equal access to information is ensured, without unreasonably restricting HFT and tech-innovation. Further, SEBI should clarify that traders should be provided equitable access across different exchanges *inter se* as well.[36]
- Exchanges should be prohibited from implementing measures which effectively deny access to co-location or data feeds to certain traders, such as prohibitive or preferential pricing. Theoretical support for this measure can also be found in the SEBI (Prohibition of Insider Trading) Regulations, 2015 ("**Insider Trading Regulations**"), especially if HF

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[34] Sucheta Dalal, *High-frequency trading needs a detailed probe* (Moneylife Jul. 8, 2015), http://www.moneylife.in/article/high-frequency-trading-needs-a-detailed-probe/42620.html; U.S. exchanges have also created special types of orders for HF Traders, for example, "*hide not slide*" orders that are not displayed to other traders; *See* Lee Sheppard, *A Tax to Kill High Frequency Trading*, Forbes, October 16, 2012, (Page 2, 4) http://www.forbes.com/sites#/sites/leesheppard/2012/10/16/a-tax-to-kill-high-frequency-trading/.

[35] SEC's Regulation NMS requires a consolidated Securities Information Processors feed to consolidate and calculate a National Best Bid and Offer ("**NBBO**"), before it disseminates market information to the public. This is not required for proprietary data feeds and therefore, instead of waiting for the NBBO, algorithmic traders could use the proprietary feeds to make their calculations faster than the NBBO calculation. *See* Testimony of Bradley Katsuyama before the Permanent Sub-committee on Investigations, *Conflicts of Interest, Investor Loss of Confidence, and High Speed Trading in U.S. Stock Markets*, June 17, 2014, at 5, http://www.hsgac.senate.gov/subcommittees/investigations/hearings/conflicts-of-interest-investor-loss-of-confidence-and-high-speed-trading-in-us-stock-markets. *See* also Scott Patterson & Jenny Strasburg, *For Superfast Stock Traders, a Way to Jump Ahead in Line*, Wall Street Journal (Sept. 12, 2012), http://www.wsj.com/articles/SB10000872396390443989204577599243693561670.

[36] This has recently (November, 2015) become an issue for BSE co-locations, because allegedly the NSE gives tick-by-tick data to its co-locaters, but does not provide the same date for BSE co-locaters. The NSE denied that it does not provide its fast market data to BSE co-locaters, in response to a query raised by Business Standard; *see* StockMarkets.in, *Brokers cry foul over NSE's data feed speed in BSE colo facility*, (November 19, 2015), http://stocksmarket.in/225677/2015/11/19/brokers-cry-foul-over-nses-data-feed-speed-in-bse-colo-facility/.

> Traders can access enriched data before such data is made public. In my view, this falls within the spirit, though not the letter, of the Insider Trading Regulations.[37] Such data may be viewed as unpublished price-sensitive information ("**UPSI**") relating to Indian listed securities. For example, an HF Trader may use such enriched data to detect a sale of a large block of shares by an institutional investor or the promoters of a company, before such news becomes generally available. Assuming such information is UPSI, HF Traders would be prohibited from trading in the securities of the company, for so long as the information does not become public.[38]

The counter to this argument is that the data provided by the exchange, in its raw form, is not UPSI as it is of no use by itself. It only becomes useful trading information when algorithms analyze the data and the market for such securities. Merely because this analysis can be completed before this data becomes public (usually mere milli or micro-seconds later), is not sufficient to label such data as UPSI, even though this small time-window is sufficient for the algorithmic trader to profitably trade based on such information. In support of this argument, the Justice Sodhi Committee Report recommended that '*generally available information*' (which is linked to the test for UPSI as above), should be defined as information available on a non-discriminatory basis; this was incorporated in the Insider Trading Regulations.[39] This was after the Committee stated that '*conclusions, deductions and inferences drawn from information analyzed by an insightful mind*' should not be treated to be UPSI.[40] Therefore, it is arguable that the results of the data analysis undertaken by HFT algorithms are not UPSI since they are conclusions drawn from market data.

However, the Committee also considered information which is priced in a manner which allows only certain identified persons to acquire such

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[37] The New York Attorney General labeled HFT as "*insider trading version 2.0*" as it falls outside the parameters of traditional insider trading; but it gives certain traders access to market-moving information which is not available to the rest of the market; *See* N.Y. Attorney General, *Remarks on High-Frequency Trading & Insider Trading 2.0*, New York Law School Panel on "Insider Trading 2.0 – A New Initiative to Crack Down on Predatory Practices", (as Delivered, Mar. 18, 2014), Eric T. Schneiderman, http://www.ag.ny.gov/pdfs/HFT_and_market_structure.pdf.

[38] *See* SEBI (Prohibition of Insider Trading) Regulations 2015 ("Insider Trading Regulations"), §4 r/w 2(n).

[39] *See* Proposed §2(f), N.K. Sodhi Committee, *Report of the High Level Committee to Review SEBI (Prohibition of Insider Trading Regulations, 1992* (SEBI), Dec. 7, 2013, http://www.sebi.gov.in/cms/sebi_data/attachdocs/1386758945803.pdf.

[40] *Id*. at ¶30, Note to Proposed §2(f); *See also* Corporations Act 2001, §1042C(1)(c) (Australia), "*When information is generally available*", http://www.austlii.edu.au/au/legis/cth/consol_act/ca2001172/s1042c.html, which contains a similar provision.

information, as being information having discriminatory access, *ergo* not generally available, *ergo* UPSI. Therefore, there is policy support for SEBI to restrict the exchanges from prohibitively pricing access to co-location and data feeds.

- SEBI may consider providing that co-location facilities should be provided by independent third-parties and not the exchanges. For example, to remove any conflict of interest, BSE does not own its co-location facilities and allows co-location data-centre vendors to set-up at the exchange.[41]
- Equal latency amongst all co-locaters at one exchange should be provided for, instead of similar latency, simply achieved by providing for equidistant cabling;[42]
- SEBI should reconsider its minimalist regulatory role in co-location and should require exchanges to frame co-location rules and seek SEBI approval prior to their implementation.[43] This issue is discussed in greater detail in Part IV and V of this Article.
- Exchanges should be required to disclose to the public, details of the structure, mechanics, features, attributes, etc. of their systems, trading platforms, their effects on the markets or trading experience, including disclosing any effects which are not readily apparent;[44] and
- Lastly, SEBI should thoroughly investigate allegations of preferential access or inside information being given to HF Traders and the claims of the NSE whistleblower, discussed above. This is on the heels of SEBI's Technical Advisory Committee finding that the NSE violated fair access norms, allowing some traders to benefit therefrom. In this case, SEBI should appoint an independent tech-consultant to study the vulnerabilities of Indian exchange systems and to investigate allegations of fraud, collusion, etc., who must report directly to SEBI.[45]

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41 *Supra* note 4.

42 For example, the Chicago Mercantile Exchange and the Hong Kong Exchange. *See also* Association of National Exchanges Members of India, *Comments on Proposal on Co-location / Proximity hosting facility offered by the Stock Exchanges*, May 31, 2013, http://www.anmi.in/admin/anmiatworkfiles/Letter%20to%20SEBI%20-%20Comments%20on%20Proposal%20on%20Co-Location%20-%20Proximity%20hosting%20facility%20offered%20by%20the%20Stock%20Exchanges.pdf.

43 This is required in the U.S. where co-location services are subject to the U.S. Exchange Act, which requires prior SEC approval for rule changes, including co-location rules. *See* SEC Concept Release *supra* note 16, at 58.

44 Proposed revisions to §38.401(a) and (c), CFTC, Q&A *supra* note 9.

45 Mobis Philipose, *What action should Sebi take in NSE algo trading case*, In the Money: April 12, 2016, http://www.livemint.com/Money/R34WpIgkgLuVrFZVnHKCbM/What-action-should-Sebi-take-in-NSE-algo-trading-case.html.

B. The Order-to-trade Penalty Rule: monetary disincentive to aggressive trading

HFT commonly involves highly aggressive trading strategies, involving high volumes of cancellations and modifications of orders without any legitimate purpose. These can have a manipulative effect on the market and therefore, in 2012 SEBI introduced monetary disincentives for high daily order-to-trade ratios, known as the '*Order-to-trade Penalty Rule*'.[46] The penalty is a charge prescribed and collected by exchanges for each order that exceeded the prescribed ratios.[47] Where traders are penalized for such breaches more than ten times within a span of thirty days, exchanges could suspend traders for one hour on the next trading day.[48] However, traders can still hide bursts of manipulative HFT activity in the course of the trading day, so long as the prescribed daily limits are maintained. This should be deterred by requiring intra-day calculations as well, which should be calculated at the time of testing and approval of algorithms.

In contrast to this quantitative approach, the German *Hochfrequenzhandelsgesetz* (High-frequency Trading Act) imposes fees on disproportionately high order entries, modifications or cancellations. The amount of fees is to be determined by the exchanges on a case-to-case basis, in a manner which effectively counteracts excessive usage and associated adverse impacts on system stability and market integrity.[49] Suspension for up to 6 months can also be imposed for breaches of prescribed order-to-transaction ratios, with revocations of the participants admission to the exchanges in case of repeated failures.[50] While the German approach is nuanced and fairly strict, SEBI's approach is better suited to India's current needs, given that exchanges have monitoring systems to place to identify and initiate measures to impede order-flooding and especially, if Execution Throttles (discussed in Part IV below) are implemented. Further, it is simple to implement, has predictable consequences and SEBI can always target illegitimate, excessive or aggressive trading (or other qualitative violations), under its PFUTP Regulations.

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[46] Discussion Paper *supra* note 7.

[47] March 30 Circular *supra* note 8; The initial rates prescribed by the exchanges pursuant to this requirement were perceived by SEBI to be far too low and in 2013, SEBI directed the exchanges to double these rates; SEBI Circular dated May 21, 2013 bearing Ref. No. CIR/MRD/DP/16/2013 [May 21, 2013 Circular.

[48] May 21, 2013 Circular *Id*.

[49] *See* §17, HFTA *supra* note 9.

[50] *See* §19, HFTA *supra* note 9.

C. Testing, exchange approval and risk-controls

At the very heart of HFT, is the technology that enables it. Like all forms of technology, HFT algorithms can malfunction. For example, in 2012 a U.S. based HFT firm, Knight Capital Americas LLC lost USD440 Million from taking unwanted positions, when its algorithm went rogue for merely 45 minutes and executed over 4 million orders.[51] This threat pushed the U.K.,[52] MiFID II[53] and Germany[54] towards implementing risk-controls for algorithmic trading.[55]

SEBI had already put such measures in place in 2003, before HFT came into vogue. It required all brokers to undertake to use only authorized software.[56] In 2012, noticing the growing trend in algorithmic trading of financial instruments, SEBI added the following testing and approval requirements:[57]

- Algorithmic traders must satisfy the exchanges that algorithms have pre-defined trading limits outside of which orders cannot be pushed to the exchange's trading servers;
- Algorithmic traders must undertake that they have sufficient risk controls to prevent misuse of algorithms and real-time monitoring to identify malfunctioning algorithms;
- Algorithm software requires pre-deployment testing (functional and technical) and traders require prior exchange permission before they can provide algorithmic trading services; and

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[51] *In the Matter of Knight Capital Americas LLC,* SEC Administrative Proceeding File No. 3-15570 Release dated October 16, 2013.

[52] *See* Financial Conduct Authority, *CP15/22 Strengthening accountability in banking: Final rules*, July 2015, https://www.fca.org.uk/static/documents/consultation-papers/cp15-22.pdf.

[53] *See* Cheryl Jones, *Financial services*, Financial Services (Oct. 28, 2013), http://blogs.lexisnexis.co.uk/fs/italys-ftt-on-hft-catching-up-with-high-frequency-trading/.

[54] *See* HFTA *supra* note 9.

[55] The SEC also has a Market Access Rule (Securities Exchange Act Rule 15c3-5) which requires the establishment, documentation and maintenance of a risk management system and supervisory procedures; Further, CFTC's Proposed Regulation AT includes pre-trade risk controls (maximum order message and execution frequency per unit time, order price and maximum order size parameters), and order cancellation systems. (proposed §1.80). It also provides implementation of standards for development, testing and real-time monitoring (proposed §1.81); *See* CFTC, Q&A *supra* note 9.

[56] SEBI Circular dated August 21, 2003 bearing Ref. No. SEBI/MRD/Policy/SE/15864/2003

[57] *See* March 30, 2012 Circular *supra* at 8; May 21, 2013 Circular *supra* at 50; SEBI Circular dated August 19, 2013 bearing Ref. No. CIR/MRD/DP/24/2013 [August 19, 2013 Circular]

- All algorithmic traders are required to submit their algorithmic trading systems to a system audit every 6 months by a qualified system auditor.

However, even tested and approved algorithms may malfunction and risk-controls may not be foolproof; such controls were in place for Knight Capital, but failed. In this regard, SEBI requires traders to set-up a preventive measure called an automated execution check. This is required to ensure that algorithms account for all executed, unexecuted and unconfirmed orders placed by it, before releasing further orders. Importantly, it must ensure that malfunctioning algorithms are automatically stopped. Keeping in mind that algorithms and automated execution checks can malfunction, on the curative side, exchanges are required to ensure that they have systems to identify malfunctioning algorithms. Further, they are allowed to remove outstanding orders from malfunctioning algorithms, levy discretionary deterrent penalties including suspensions and even shut down trader terminals in case of emergencies.[58]

SEBI also requires traders to '*consider*' taking suitable insurance against software malfunctions, which should be made mandatory given the possibility of malfunctions leading to great losses. In this regard, Korsmo suggested a mixed liability-government '*responsibility waterfall*', where the first recourse would be to the funds of the trader, including insurance payouts. If the trader becomes insolvent before the losses can be recouped, recourse may be had to a common fund, like SEBI's Investor Protection and Education Fund, which should comprise compulsory contributions made by algorithmic traders or the recoveries of an HFT-targeted tax (if implemented).[59] If the fund also fails to discharge this loss, the last resort would be to approach the Government.[60]

D. Audit trails and surveillance

SEBI requires algorithmic traders to maintain logs and records of algorithmic trades. These trades are to be tagged with unique identifiers provided by the stock exchanges to establish an audit trail.[61] This is an important measure which allows *post facto* reconstruction of trading activity, which helps in the effective identification and investigation of trading violations and in the consequent assignment of responsibility for such violations. It also

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[58] March 30, 2012 Circular *supra* note 8; August 19, 2013 Circular *supra* note 59.

[59] See the section on Securities Transaction Tax in Part V below.

[60] Charles Korsmo, *High-Frequency Trading: A Regulatory Strategy*, 48 University of Richmond Law Review 588-593 (2014).

[61] March 30, 2012 Circular *supra* note 8.

helps SEBI understand market forces and serve as valuable tool for crafting regulatory strategies.

SEBI also requires traders to have real-time monitoring systems to identify malfunctioning algorithms and immediately inform the exchanges of any abnormal behavior. Exchanges are also required to put monitoring systems in place to identify and initiate measures to impede order-flooding.[62] In 2012, recognizing that there was a need to strengthen surveillance mechanisms and prevent market manipulation, SEBI directed all exchanges to ensure effective monitoring and surveillance of algorithm orders and trades.[63] However, SEBI's involvement was limited to receiving monthly reports on algorithmic trading submitted by exchanges.[64]

E. Circuit-breakers

Circuit-breakers are systems which automatically halt trading when prices move beyond prescribed limits within a trading day. These prevent excessive price fluctuations and have been implemented in India market-wide since 2001, in incremental thresholds of 10%, 15% and 20%. Once triggered, exchanges are required to stop matching orders and purge all unmatched orders in the system. Depending on the point in time in the trading day when these movements happen, trading resumes either on the same or on the next trading day.[65] To ensure that circuit-breakers are triggered as soon as possible, circuit-breaker limits are calculated daily, based on the previous day's closing level.[66]

These circuit-breakers are intended to be instantaneous. For example, pursuant to a *suo motu* special purpose inspection, SEBI censured NSE for a six-second delay between the trigger at 09:50:58 a.m. and trading halt at 09:51:04 a.m. NSE contented that it was sufficient to stop the entry of fresh orders into the system after triggering the circuit-breakers, but after executing executable orders already in the system. Stating that the legislative intent of circuit-breakers is to stop the securities market from panicking and making impulsive, irrational decisions, SEBI rejected NSE's contentions.[67] To

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[62] *Id*..

[63] May 21, 2013 Circular *supra* note 50.

[64] These reports include, apart from statistical data pertaining to turnover, volumes and percentages, details of action taken in respect of malfunctioning algorithms, status of grievances, if any, received and processed, etc. *See* March 30, 2012 Circular *supra* note 8.

[65] SEBI Circular dated June 28, 2001 No. SMDRPD/Policy/Cir-37 /2001.

[66] SEBI Circular dated September 03, 2013 bearing Ref. no. CIR/MRD/DP/ 25 /2013.

[67] *In re: National Stock Exchange of India Limited* bearing SEBI Order dated October 10, 2014 Ref. No. WTM/PS/38/MRD/DSA/OCT/2014. This resulted from an erroneous trade which was supposed to be a sell order for 17 lakhs in value but was instead placed for 17

prevent such situations from occurring and to ensure real-time monitoring, in 2015 SEBI required BSE and NSE to compute their market-wide index after every trade and run the computations through the circuit breakers. Further, SEBI required exchanges to ensure that their systems give priority to circuit-breakers and ensure immediate response times.[68]

IV. Incremental Regulatory Strategies & Measures

Despite the measures implemented by SEBI, discussed in Part III above, there are still concerns in the Indian markets with respect to market fairness and integrity. The Discussion Paper is the first step towards identifying, exploring and addressing these concerns. The first portion of this Part discusses SEBI's proposals in the Discussion Paper and is followed by a section discussing incremental measures and recommendations, based on economic and legal theory and experience gained from other markets:

Minimum Resting Time: A Minimum Resting Time ("**MRT**") is the minimum time between when an order is received by an exchange and when it can be amended or cancelled by the trader. If an order is placed during the MRT and if a matching order is placed on the other side of the buy-sell equation during the MRT, the order will be converted into a trade. This would deter traders from placing orders that they do not intend to execute and directly counteract manipulative strategies which rely on immediate modifications or cancellations to orders. For example, a common strategy is to place an order on one side of the buy-sell equation, with the actual intention of the trader being to trade on the other side. The reason for placing the initial order on the other side is to create artificial perceptions of demand and supply and to trigger a market response. If the market moves in the desired direction, the trader cancel the initial order, switches over to the other side and profits from the market reaction.[69]

However, this measure does not discriminate between valid and invalid modifications to orders, for example, valid modifications in response to new incoming news or orders versus invalid orders with the intent of creation virtual liquidity or to detect the reaction of other market participants.

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lakh scrips amounting to 980 crores. In the six seconds that it took halt trading when the NIFTY Index crashed and breached the 10% circuit-breaker, the 15% circuit-breaker had also been breached.

[68] SEBI Circular No. CIR/MRD/DP/02/2015 dated January 12, 2015.

[69] *See* FINRA, *FINRA Joins Exchanges and the SEC in Fining Hold Brothers More Than $5.9 Million for Manipulative Trading, Anti-Money Laundering, and Other Violations*, News Release, September 25, 2012, www.finra.org/Newsroom/NewsReleases/2012/P178687.

Randomized Speed Bumps: Speed-bumps echo Krugman's statement that trading in milliseconds serves no social purpose,[70] and consequently, impose delays on incoming orders. If the delay exceeds the speed-advantages enjoyed by HF Traders, it would counter latency-sensitive strategies.[71] For example, the IEX Group, a stock exchange founded by Bradley Katsuyama, the protagonist of Flash Boys, proposed an anti-HFT speed-bump of 350 microseconds.[72] It did so by placing a box containing 32 miles of fiber optic cable outside the exchange through which HF Traders have to connect to the IEX.[73] This causes a speed-bump which gives IEX enough time to process trades before HF Traders have time to receive and act on that information. Similarly, the TMX Group in its new TSX Alpha Exchange model has implemented a non-discriminatory speed-bump on order processing and believes that this will assist natural order flow and improve liquidity.[74] However, TSX Alpha's speed bump is of a random duration, within a set lower and upper limit of 1-3 milliseconds, which is perceived as reflective of existing network latencies.[75] This adds another variable to negate arbitrage and latency-sensitive strategies. Such a randomized speed-bump is one of the proposals in the Discussion Paper.

Frequent Batch Auctions: Eric Budish *et al* (2015) devised Batch-auctions as a market-design solution to HFT. Their proposal was to divide the trading day into extremely frequent but discrete time-intervals. During these intervals, exchanges would collect orders which would be matched at the end of such intervals. This would replace the continuous matching of orders on a

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[70] Krugman *supra* note 2.

[71] *Id.*

[72] *See* Exhibit E, Investors' Exchange, LLC, Form 1, September 15, 2015, (Application for Registration as a National Securities Exchange under Section 6 of the Securities Exchange Act of 1934), http://www.sec.gov/rules/other/2015/investors-exchange-form-1-exhibits-a-e.pdf#page=2.

[73] Jacob Adrian, *Informational Inequality: How High Frequency Traders Use Premier Access to Information to Prey on Institutional Investors*, 14 *Duke Law & Technology Review* 256-279 (2016), http://scholarship.law.duke.edu/dltr/vol14/iss1/11.

[74] Barbara Shecter, *TMX Group to install 'speed bump' to slow HFT traffic, ahead of Aequitas launch*, (October 23, 2014), http://business.financialpost.com/news/fp-street/tmx-group-to-install-speed-bump-to-slow-hft-traffic-ahead-of-aequitas-launch. *See also* §5.9, Alpha Exchange Inc. Notice of Proposed Rule Amendments and Request for Comments, http://www.osc.gov.on.ca/documents/en/Marketplaces/alpha-exchange_20141106_amd-request-for-comments.pdf.

[75] Ontario Securities Commission, *OSC Staff Notice – Notice of Commission Approval to Proposed Changes to Alpha Exchanges Inc.*, www.osc.gov.on.ca/documents/en/Marketplaces/alpha-exchange_20150421_noa-proposed-changes.pdf; Originally, this interval was to be between 5-25 milliseconds, with a fixed difference to be established between the lower and upper limits between 1 to 10 milliseconds. The limits would be fixed and communicated to all participants in advance. *See* John McCrank, *IEX responds to critics of 'flash boys' speed bump* (Reuters 2015), http://www.reuters.com/article/iexgroup-exchange-response-idUSL1N13B2I320151116.

first-come first-serve basis.[76] The chosen interval would be small enough to be economically insignificant, for example 500 milliseconds. This system would operate like an auction, where the best price would win, not the fastest move. Time-priority would therefore take a back seat, only to be resorted to in case of a dead-lock *i.e.* if two orders are priced the same, an earlier order would win over a later order; importantly, this would mean that a later but better price would win over an earlier but lower price within the same interval.

McPartland points out that Batch-auctions would probably reduce I.T. load on exchange servers as the trade matching servers need not run continuously. This could negate the practice of "*quote stuffing*" where HF Traders intentionally clog trading systems with orders. It would also reduce the audit trail and consequently improve supervisory capabilities. Further, given that a batch-auction is like executing a large order (for example, 10,000 lots) versus executing many small orders (for example, 10,000 small lot orders) and that processing one small lot order consumes the same amount of I.T. resources as one 10,000 lot order, Batch-auctions should materially reduce the operating expenses of trading venues, clearing organizations, and trade intermediaries.[77]

An additional layer of complexity can be introduced into this system by matching orders at a random point in time in the batch-auction trading interval (instead at the end of the trading-interval). This would prevent HF Traders from knowing (or being able to estimate) how long their orders will have to wait in the system before they can be matched and whether their speed-advantage would still exist at that point in time. This may result in non-*bona fide* orders (i.e. which the HF Traders intended to cancel or modify), being converted into trades, if such orders are present in the system when the exchange matches orders. Consequently, genuine orders will have a greater probability of execution. In theory, this would result in lower HFT executions, which would increase their order-to-trade ratios and the risk of breaching the Order-to-trade Penalty Rule, which would therefore act as a

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[76] Eric Budish *et al*, *The High-Frequency Trading Arms Race: Frequent Batch Auctions as a Market Design Response*, 130:4 Q.J.E. 2015; Currently the most widely-used trading mechanism in financial markets is the "*continuous double auction electronic order book with time priority*". This method is continuous and execution priority is assigned based on the price of quotes and their arrival order. J. Doyne Farmer, *Review of the benefits of a continuous market vs. randomised stop auctions and of alternative Priority Rules* (policy options 7 and 12) c1, 28 March 2012, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/289050/12-1072-eia11-continuous-market-vs-randomised-stop-auctions.pdf; However, a form of batch-auctions are implemented by the BSE and NSE for opening and closing sessions; *See* Discussion Paper *supra* note 7.

[77] McPartland *supra* note 23, at 22.

deterrent to HFT. Another version of the batch-auctions is an order-randomization batch auction where orders are randomized (not the trade-matching point within the interval) before being executed. For example, ICAP's EBS introduced what it calls a "*latency floor*" on certain trades where orders are bundled into small batches and their place in the queue would be randomized i.e. not based on time-priority.[78] However, it may be possible to overcome order randomization by submitting a larger number of orders so that more HFT orders make it into every batch. Therefore, order randomization may need to be implemented in tandem with a speed bump.[79]

Maximum Order-to-Trade ratios or Execution Throttles: Execution throttles are measures which prevent HF Traders from exceeding a set order-to-executed trade ratio i.e. ensuring that at least one trade is executed for a set number of orders issued by the trader. Unlike the current '*Order-to-Trade Penalty Rule*' which allows traders to exceed prescribed ratios subject to penalties, the execution throttle would not allow the trader to issue orders in excess of the prescribed ratio.[80] Currently, the NSE has prescribed a throttle to prevent algorithms malfunctions.[81] Going further, the attempt in the Discussion Paper is geared towards prevention of volume-based market manipulation (and not merely algorithm malfunctions) and is expected to increase the likelihood of a viewed quote being available to trade. However, this measure is blunt, given that it seeks to prescribe a fixed quantitative rate regardless of the legitimacy of the underlying trading strategies.

Separate Queues for Co-located orders and non-co-located orders: In furtherance of a consultative effort to revise co-location rules in 2013, SEBI proposed in the Discussion Paper to implement an order handling architecture, where orders would be segregated into two separate queues for co-located and non-co-located orders. Validated orders from each queue would be time-stamped and forwarded based on a round-robin methodology i.e. orders would be picked up from each queue alternatively. The only situation where two orders from the same queue would be executed one after another

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[78] Wanfeng Zhou and Nick Olivari, *Exclusive: EBS Take New Step to Rein in High-Frequency Traders*, REUTERS (Aug. 23, 2013), http://in.reuters.com/article/us-markets-forex-hft-idUSBRE97M0YJ20130823.

[79] Jacob Adrian *supra*, note 75.

[80] The CFTC contemplated such measures which would inform a trader and the exchanges if the prescribed rate has been exceeded; CFTC, *Concept Release on Risk Controls and System Safeguards for Automated Trading Environments*, 6351-01-P CFTC 17 CFR Chapter I RIN 3038-AD52, ¶96 at 83, www.cftc.gov/ucm/groups/public/@newsroom/documents/file/federalregister090913.pdf.

[81] Mobis Philipose, *Algorithmic trading: Curbing the risks involved* (In the Money: 2016), http://www.livemint.com/Opinion/ng7YwcspZXIqmOtFab9BkK/Algorithmic-trading-curbing-the-risks-involved.html

(without the exchange executing an order from the other queue in between these two orders), is if the other order-queue is empty. Until a valid order arrives in the empty queue, orders can be picked up sequentially.[82]

Review of Tick-by-Tick data feed: Part II of this Article highlighted that data feeds provided by exchanges should be equitably distributed and accessible. In furtherance of this objective, I recommended in Part IV of this Article that differentials in data feeds should not be permitted. However, SEBI is considering a more fundamental issue i.e. whether exchanges should give every piece of market information. This refers to Tick-by-Tick ("**TBT**") data feeds provided by exchanges which provide details of additions, modifications and cancellations to orders, and trades on a real-time basis. These can be used by HF Traders to virtually recreate the order-book whilst most ordinary traders either cannot afford to buy access to these feeds, or properly analyze these feeds, which creates information asymmetry.

In this regard, SEBI proposed that exchanges should only provide '*Structured Data*' which would contain the only the top 20-50 bids, asks, market depth, etc. to all market participants, either at prescribed time intervals or in real-time. This measure is probable far too regressive to seriously consider. I believe that exchanges need to be fully transparent and should disclose all data available to it. The focus instead, should be on measures (such as prohibiting preferential or prohibitive pricing, improving public dissemination systems, etc.) that enhance access and reach to the public.

These proposals cover the chief regulatory options that are already in the contemplation of regulators and markets across the globe. In addition to these proposals, the following measures may be considered:

Securities Transaction Tax: In the 1970's, Tobin called for a tax on securities transactions ("**STT**") to throw "*sand in the wheels*" of international trading markets.[83] This was aimed at encouraging long-term, value based investments, since the effect of STT on such investments would be negligible;[84] though some consider this to be an unnecessary economic impediment.[85] It also has the dual benefit of, like other prohibitive taxes such as

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[82] Co-location Discussion Paper, *supra* note 15.

[83] This was first proposed by Keynes in 1936 reduce destabilizing speculation in equities by Keynes and later, in 1978, by Tobin in relation to destabilization of currency speculation; Edward Sun and Timm Kruse, *Optimal High-Frequency Trading with Financial Transaction Tax,* https://editorialexpress.com/cgi-bin/conference/download.cgi?db_name=CEF2015&paper_id=71.

[84] Kavaljit Singh, *India introduces securities transaction tax*, Counter Currents (Jul. 20, 2004), http://www.countercurrents.org/eco-singh200704.htm.

[85] *See* Tyler Durden, *First Ever High Frequency Trading Transaction Tax Introduced In Italy*, Zero Hedge, February 9, 2013, http://www.zerohedge.com/news/2013-09-02/first-ever-high-

Cigarette taxes, discouraging unwanted activity and earning revenue at the same time.

India already imposes STT which applies equally to HFT as it does to ordinary trading. In contrast, the French imposed an HFT specific tax in 2012 on modified and cancelled orders for securities of large public companies, which was the first of its kind.[86] Italy too imposed a tax in 2013 on HFT, in addition to ordinary STT. For this purpose, the Italian tax differentiated between HFT and ordinary trading, and applied STT to rapid-fire trades (*i.e.* trades generated, modified or cancelled within intervals of 500 milliseconds (or less)), where the sum of such trades exceed 60% of the total orders of a particular trading day.[87]

This has recently gained favour in the E.U.[88] and the U.K.[89] In line with this European trend, Hillary Clinton, in her Presidential campaign proposals, also promised to tax HFT cancellations, believing them to be risky and harmful practices, which should not be allowed to hide under the cloak of risk-management practices.[90]

Minimum Tick Sizes: Minimum tick size ("**MTS**") is the smallest pricing increment by which the price of a listed security can be improved. To illustrate: if one rupee is the MTS, increments in paise are not allowed. The

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frequency-trading-transaction-tax-introduced-italy. [Zero Hedge is a conspiracy/activist blog, whose editors/writers collectively use the pseudonym Tyler Durden to maintain anonymity. This refers to a character in the movie "*Fight Club*", a mysterious extremist who launches "*Project Mayhem*" to erase debt by bombing buildings used by credit card companies to keep records.]

[86] Maria Coelho, Dodging *Robin Hood: Responses to France and Italy's Financial Transaction Taxes*, July 17, 2014, https://www.sbs.ox.ac.uk/sites/default/files/Business_Taxation/Events/conferences/doctoral_meeting/2014/coelho.pdf

[87] *See* Tyler Durden, *supra* note 94. Market-making, subject to certain other compliances, is exempted from this tax.

[88] *See High-frequency trading is a blight on markets. Tobin tax can help*, Financial Crisis (Capital Institute Apr. 4, 2014), https://capitalinstitute.org/blog/high-frequency-trading-blight-markets-tobin-tax-can-help/; Basserdan, *A Tax to Kill High Frequency Trading* (Investors Hub Oct. 16, 2015), http://investorshub.advfn.com/boards/read_msg.aspx?message_id=80680768

[89] *See* The Kay Review of UK Equity Markets and Long–Term Decision Making, House of Commons Business, Innovation and Skills Committee, Third Report of Session 2013–14, http://www.publications.parliament.uk/pa/cm201314/cmselect/cmbis/603/603.pdf. (Recommending that the UK Government should consider the viability, benefits and risks of an FTT on HFT)

[90] Jennifer Epstein, *Hillary Clinton to propose high-frequency trading tax, Volcker rule changes* (Bloomberg.com/politics Oct. 8, 2015), http://www.bloomberg.com/politics/articles/2015-10-08/hillary-clinton-to-propose-high-frequency-trading-tax-volcker-rule-changes.

U.S.,[91] Europe[92] and Indian exchanges have prescribed MTS; in fact, the BSE is targeting HFT by increasing MTS for certain securities, since MTS benefits HFT by allowing HF traders to easily improve quoted prices.[93]

Given the above, a greater MTS should reduce HFT opportunities by reducing pricing options available to algorithmic traders. By ruling out finer pricing increments, orders will get clustered at certain price points i.e. there will be increased liquidity at such price-points. However, Yao and Ye disagree; they believe that a higher MTS takes away non-algorithmic trading options to complete with algorithmic traders based on price, since the likelihood of both kinds of traders quoting the same price is increased (due to the lack of options). Therefore, HFT would be favoured in time-priority based dead-lock resolution.[94] This would increase speed-based competition and take away price-based competition.

V. Who Should Ride The Regulatory Bicycle?

Parts II, III and IV of this Article address the '*what*', '*why*' and '*how*' to regulate HFT. This section explores '*who*' should be regulating HFT. Currently, as discussed in Part III, SEBI has heavily delegated its regulatory responsibilities to the exchanges. This allows it to regulate the securities market from the vantage point of the exchanges, being the point of intersection of all market-participants. However, investor associations have alleged that such delegation is against the letter and spirit of securities law.[95] This issue was brought to light by whistleblower allegations that the NSE is/has colluded

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[91] *See* Maureen O'Hara *et al*, *Relative Tick Size and the Trading Environment*, December 2013 at 2, n.4, https://www.sec.gov/spotlight/investor-advisory-committee-2012/wallman-roper-iac.pdf.

[92] *Id*.

[93] Palak Shah, *BSE increases minimum price movement of stocks and Sensex futures to attract more volumes* (timesofindia-economictimes Dec. 2, 2011), http://articles.economictimes.indiatimes.com/2015-01-05/news/57705327_1_sensex-futures-destimoney-securities-tick-size.

[94] Chen Yao and Mao Ye, *Tick Size Constraints, Market Structure, and Liquidity*, December 28, 2013 (draft), at 33, 34, https://www.aeaweb.org/aea/2014conference/program/retrieve.php?pdfid=842.

[95] Sundaresha N. Subramanian, *Investor Association Moves House Panel on Algorithm Trades*, Oct. 1, 2015, http://www.business-standard.com/article/markets/investor-association-moves-house-panel-on-algorithm-trades-115100100703_1.html. An investor association has also filed a Writ Petition against SEBI, in this regard. *See Intermediaries And Investor Welfare Assn. (India)* v. *SEBI*, WP (C) No. 5082 of 2012, decided on 28-3-2016 (Del); *See also* Mobis Philipose, *Has Algorithm trading hurt investors*, (In the money: Jun. 2016), http://www.livemint.com/Money/5BPyj4B5tET3O8ruIzY8BK/Has-algorithmic trading-hurt-investors.html.

with traders to manipulate the stock markets.[96] The whistleblower claims that bribery in the NSE is rampant and that the management and promoters of NSE unfairly favored a trading company, of which the NSE was the second largest shareholder.[97] Similar concerns have been expressed in other jurisdictions as well.[98] If that were true, is it not dangerous to allow the exchanges to regulate HFT?

The exchanges that should be protecting investors have been allowed to become profit-making bodies, which can have direct physical relationships with certain traders (co-location). Their profitability and the compensation of their management is often contingent on trading volume.[99] HFT brings the most volume and naturally, there is an expectation of bias. Given this in-built conflict of interest in market structure, it may not be wise to allow exchanges to regulate the very activity that it promotes and profits from. While some would simply eliminate the self-regulatory status of exchanges,[100] I believe that the focus should be on greater oversight by SEBI and on checks and balances to ensure that HFT is not allowed to flourish unrestricted.

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[96] This is based on an anonymous whistleblower's letter made public last year, which alleges that the NSE allowed co-location services on a preferential basis and inside information to an HF Trader, which allowed the trader to exploit inherent loopholes in the co-location system and cheat the market. *See* Sucheta Dalal, *Blowing the whistle on manipulation in NSE* (Jun. 19, 2015), http://www.moneylife.in/article/blowing-the-whistle-on-manipulation-in-nse/42337.html. This letter was made public by Sucheta Dalal it her article in Moneylife, which claimed that no action was being taken by the NSE to investigate the matter. The NSE filed a defamation suit against Ms. Dalal and her editor at Moneylife, in relation to her article, which was dismissed by Justice G.S. Patel in September, 2015. *See National Stock Exchange of India Ltd.* v. *Moneywise Media (P) Ltd.*, 2015 SCC OnLine Bom 4790: (2015) 132 SCL 312 (Bom).

[97] This is not true *per se* as NSE indirectly held 26% of the trader through Dotex International Ltd. a wholly owned subsidiary of NSE. Therefore, though it controlled 26% of Omnesys shares, it was not a shareholder of Omnesys. *See* National Stock Exchange of India Ltd., In re, 2014 SCC OnLine Comp at 37. The letter also suggests that once co-location was made multi-cast, the traders' market share fell off the charts (since it could no longer cheat the system) and the NSE sold its stake in to Reuters. *See* Sachin Mampatta, *NSE, Others Sell Stake in Algo-Venture Omnesys*, Sept. 16, 2013, http://www.business-standard.com/article/markets/nse-others-sell-stake-in-algo-venture-omnesys-113091600641_1.html.

[98] Lewis, *supra note* 3.

[99] *MCX Stock Exchange Ltd.* v. *National Stock Exchange of India Ltd.*, 2011 SCC OnLine CCI 52.

[100] Stanislav Dolgopolov, *High-Frequency Trading, Order Types, and the Evolution of the Securities Market Structure: One Whistleblower's Consequences for Securities Regulation* (May 8, 2014), University of Illinois Journal of Law, Technology & Policy, Vol. 2014, pp. 145-175, 2014. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2314574; [quoting Haim Bodek.]

VI. Findings & Recommendations

The Discussion Paper explores concerns relating to market quality, integrity and fairness arising from HFT and seeks to address these concerns with its proposals. While I concede that it is merely a preliminary step in the process of revising SEBI's regulatory framework, it does not add much value and is not much more than a general reiteration of measures and mechanisms, currently under the consideration of other stock exchanges and regulators. Its key failings are on account of the fact that it does not contain specifics of the proposals; or give details of the nature, scope and extent of the problems faced by Indian markets; is not grounded on India focused empirical evidence; and does not provide an implementation plan for any of its proposals. This has resulted in a *prima facie* examination of these proposals in vacuum. Nonetheless, and subject to the over-arching requirement to support each recommendation with robust economic research, the following recommendations best meet the objective of the Discussion Paper:

- Given the concerns discussed in Part V above, deeper involvement of SEBI may be critical in regulating HFT. If SEBI wishes to delegate regulatory powers to the exchanges, it should require prior SEBI approval to rules framed by the exchanges before they are implemented. As recommended above in Part IV (in relation to co-location), I recommended that SEBI may consider requiring exchanges to seek SEBI approval before such exchanges implement any new rules. Alternatively, SEBI may consider a separate licensing regime for HF Traders, which would impose continuous '*fit and proper*' criteria to be maintained by licensees. For example, the U.S. Financial Industry Regulatory Authority ("**FINRA**") plans to issue non-public report cards to HF Traders based on the legitimacy of their trading strategies.[101]

SEBI may also consider setting up an independent supervisory body to supervise HFT, which function under the aegis of SEBI. This would body should be given the power to seek information from algorithmic traders, on a confidential basis, including descriptions of HFT strategies and details of trading activity, especially details of when these algorithms and strategies were implemented.[102] This body should constantly monitor the markets for violative, fraudulent and manipulative activity and report any actual or suspected fraudulent, manipulative or illegitimate activities to SEBI. In this

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[101] David Michaels, *Wall Street to Get Graded on How Much Spoofing It's Facilitating*, Jan. 5, 2016, http://www.bloomberg.com/news/articles/2016-01-05/wall-street-to-get-graded-on-how-much-spoofing-it-s-facilitating.

[102] §1(a), HFTA, *supra* note 9.

regard, Dolgopolov suggested, as a possible alternative to the U.S. securities market structure, to have exchanges delegate enforcement and surveillance functions to an independent third party.[103] For example, Direct Edge and NASDAQ have voluntarily delegated some surveillance functions on their equity markets to the FINRA.[104]

- Amongst the measures proposed by SEBI, MRT, speed-bumps and execution throttles appear promising, for the time being. Of these, execution throttles should have the fewest risks and unknowns, given that it is an extension of the existing '*Order-to-Trade Penalty Rule*'. Further, execution throttles only restrict trading strategies while a MRT or speed-bump could possible entirely negate the benefits of co-location, and are therefore likely to be better received by the market. However, SEBI would have to determine an appropriate cut-off level for the throttle which will involve the delicate exercise of distinguishing between legitimate and illegitimate throttle ratios.[105] To begin with, SEBI should start with a conservatively high throttle-rate and target only serious manipulative strategies. After observing the throttle in practice, it may consider lowering the throttle-rate, or even providing for variable rates for different cases, situations or securities, if required.

However, SEBI will have to think this measure through, since currently the Discussion Paper does not explain how the throttle will be implemented; *e.g.* it does not specify what is to happen when a trader hits the throttle limit. At this point, if such trader cannot issue fresh orders, his order-to-trade ratio cannot be brought down and he would effectively be in limbo.

- Batch-auctions and randomization would increase pre-execution order exposure and significantly reduce, if not eliminate, the speed-advantages enjoyed by algorithmic traders and therefore negate the value of co-location. A review of the research on associated effects of these measures, reveals conflicting results. In 1998, researchers significantly concluded that the call market method was half as volatile as the continuous auction method, including in high volume stocks, on the Taiwan Stock Exchange. Further, they found that it did not impair liquidity and price discovery in the call market appears more

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[103] Dolgopolov, *supra* note 102.

[104] See, e.g., Press Release, *Direct Edge & Fin. Indus. Regulatory Auth., Direct Edge Selects FINRA for Market Surveillance* (May 22, 2013), http://www.finra.org/Newsroom/NewsReleases/2013/P265419.

[105] SEC Chair Mary Jo White, *Enhancing Our Equity Market Structure*, Speech at the Sandler O'Neill & Partners, L.P. Global Exchange and Brokerage Conference, New York, N.Y. (June 5, 2014), http://www.sec.gov/News/Speech/Detail/Speech/1370542004312.

efficient than in the continuous auction market.[106] Similarly, other studies between then and now associate the presence of call auctions with reduced volatility.[107] Given that these studies are conducted on different exchanges with different market characteristics, the most relevant piece of research is Camilleri's 2015 study on the effects of the opening and closing call-auctions at the NSE, which indicated increased volatility during the auction period (though he Camilleri declared that the increase was statistically insignificant).[108] Assuming that this is true (and which will need to be confirmed across other exchanges and platforms as well[109]), batch-auctions may be a viable option. However, the revised market structure should be well thought through and supported by robust research.

- With respect to separate queues for co-located and non-co-located traders, there is likely to be heavy opposition from co-located traders; though as SEBI rightly pointed out in the Discussion Paper, co-locaters would still receive data feeds faster due to their proximity to the trading servers. This, coupled with the ability to make trading decisions faster than ordinary traders, would allow HF Traders to retain their competitive advantage. However, SEBI should note that there may be ways for HF Traders to work around these queues; the Association of National Exchanges Members of India (ANMI) pointed out that non-colocated order queue can be gamed by issuing orders proximity hosting locations (a variant of co-location offered by stock exchange, where traders can set up their systems outside, but close to, the exchanges premises, with direct connectivity with the trading platform).[110] This would allow HF Traders to use the speed benefits of co-location to receive and process market information and thereafter, issue non co-located orders from the proximity location

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[106] Rosita Chang *et al, The Effects of Trading Methods on Volatility and Liquidity: Evidence from the Taiwan Stock Exchange,* (Aug. 1998), http://www2.hawaii.edu/~rheesg/Belgrade/Taiwan/TSEfinal.pdf

[107] Silvio Camilleri, *The Impact of Stock Market Structure on Volatility: Evidence from a Call Auction Suspension, University of Malta*, March 23, 2015, http://www.sciedu.ca/journal/index.php/ijfr/article/viewFile/6700/4014.

[108] *Id*.

[109] Haas and Zoican (2016) recently found that batch-auctions did not have stock-specific impacts and could therefore be implemented exchange wide; Marlene Haas and Marius Zoican, *Discrete or continuous trading? HFT competition and liquidity on batch auction markets*, February 26, 2016, http://people.stern.nyu.edu/jhasbrou/SternMicroMtg/SternMicroMtg2016/Papers/36.pdf. This should be confirmed in the context of Indian markets.

[110] ANMI, Response to SEBI Discussion paper on Strengthening the Regulatory framework for Algorithmic Trading & Co-location (Aug. 30, 2016), available at http://www.anmi.in/pdfs/SEBI-Discussion-paper_Algorithmic-Trading_Co-location_29062016.pdf.

servers (which may be placed in the non co-location order queue). Further, HF Traders can overcome separate queues by placing multiple orders in both queues and once either order is executed, cancelling the other order. This would add noise to both trading and market data and load on the exchange's servers. Furthermore, HF Traders may be to develop predatory algorithms to take advantage of the non co-located order queue.[111] However, if an MRT is imposed during which orders cannot be cancelled, at least the concern of HF Traders placing orders in both queues will be solved.

- An HFT specific tax is not advisable, since India already imposes a generic STT and economically de-incentivizes excessive trading. Further, it would probably wipe out HFT's slim profit margins.[112] It also has the disadvantage of not being able to differentiate between legitimate and unfair or manipulative HFT practices.
- An HFT-targeted MTS can be implemented with caution, possibly in tandem with some form of time-based speed breakers. This measure in particular, will depend on supporting economic research and an analysis of the associated effects on transaction costs, market depth, liquidity and volatility.

Lastly, a word of caution. It is possible for each of these measures to have widespread disruptive effects on the markets, including driving trading volume overseas.[113] The complexity of these measures (depending on the final implementation plan) may result in increased operational costs and risks. Furthermore, some of its proposals *e.g.,* randomized speed-bumps are based on experiences of market microstructures, which may have completely different dynamics and characteristics than the Indian markets.[114] All of these will have to be kept in mind when SEBI finalizes its revised regulatory framework.

VII. Concluding Remarks

Given the explosive growth of HFT and the consequent paradigm shift in trading fundamentals, there is palpable regulatory unease in the securities

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[111] Association of National Exchanges Members of India, *Comments on Proposal on Co-location / Proximity hosting facility offered by the Stock Exchanges*, May 31, 2013, http://www.anmi.in/pdfs/Letter%20to%20SEBI%20-%20Comments%20on%20Proposal%20on%20Co-Location%20-%20Proximity%20hosting%20facility%20offered%20by%20the%20Stock%20Exchanges.pdf

[112] Lee Sheppard, *supra* note 36.

[113] ANMI, *supra* note 112.

[114] ANMI, *supra* note 112.

markets. SEBI has the second-mover's advantage and should consider a pre-emptive upgrade on the lines discussed above, especially considering the frequency, variety and severity of risk and violations associated with HFT.

Dolgopolov rightly pointed out that technological developments cannot be reversed, and the search for regulatory arbitrage and loopholes cannot be stopped.[115] Therefore, these measures will have to be flexible enough to react to arbitrage as it happens. If SEBI implements the recommended measures in Part V above (subject to thorough India specific economic research and a well thought through implementation plan), it may well be successful in restoring the faith of the public investors in the integrity of the Indian securities markets.

[115] Dolgopolov, *supra* note 102.