SECURITIES AND EXCHANGE COMMISSION
(Release No. 34-78860; File No. SR-CHX-2016-16)

September 16, 2016

Self-Regulatory Organizations; Chicago Stock Exchange, Inc.; Notice of Filing of Proposed Rule Change to Adopt the CHX Liquidity Taking Access Delay

Pursuant to Section 19(b)(1) of the Securities Exchange Act of 1934 ("Act")[1], and Rule 19b-4[2] thereunder, notice is hereby given that on September 6, 2016, the Chicago Stock Exchange, Inc. ("CHX" or "Exchange") filed with the Securities and Exchange Commission ("Commission") the proposed rule change as described in Items I, II and III below, which Items have been prepared by the Exchange. The Commission is publishing this notice to solicit comments on the proposed rule change from interested persons.

I. Self-Regulatory Organization's Statement of the Terms of Substance of the Proposed Rule Change

CHX proposes to amend the Rules of the Exchange ("CHX Rules") to adopt the CHX Liquidity Taking Access Delay. The text of this proposed rule change is available on the Exchange's website at http://www.chx.com/rules/proposed_rules.htm, at the principal office of the Exchange, and at the Commission's Public Reference Room.

II. Self-Regulatory Organization's Statement of the Purpose of, and Statutory Basis for, the Proposed Rule Change

In its filing with the Commission, the self-regulatory organization included statements concerning the purpose of, and basis for, the proposed rule change and discussed any comments it received on the proposed rule change. The text of those statements may be examined at the places specified in Item IV below. The Exchange has prepared summaries, set forth in sections A, B and C below, of the most significant parts of such statements.

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1 15 U.S.C. 78s(b)(1).

2 17 CFR 240.19b-4.

A. Self-Regulatory Organization's Statement of the Purpose of, and the Statutory Basis for, the Proposed Rule Change

1. Purpose

Background

The Exchange proposes to adopt the CHX Liquidity Taking Access Delay ("LTAD"). LTAD is designed to neutralize microsecond speed advantages exploited by low-latency market participants engaged in latency arbitrage[3] strategies that diminish displayed liquidity and impair price discovery in national market system ("NMS") securities.[4] In sum, LTAD would require all new incoming orders[5] received during the Open Trading State[6] that could immediately execute

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3 As used herein, "latency arbitrage" means the practice of exploiting disparities in the price of a security or related securities that are being traded in different markets by taking advantage of the time it takes to access and respond to market information. Given its emphasis on speed, latency arbitrage has resulted in a well-documented and escalating technology race among certain market participants seeking to obtain ever smaller speed advantages. See Eric Budish, Peter Cramton and John Shim, "The High-Frequency Trading Arms Race: Frequent Batch Auctions as a Market Design Response," Quarterly Journal of Economics, Vol. 130(4), November 2015 ("Budish Paper"); see also e.g., Elaine Wah and Michael Wellman. 2013. "Latency Arbitrage, Market Fragmentation, and Efficiency: A Two-Market Model." 14th ACM Conference on Electronic Commerce, June. In recent years, a significant amount of academic research has been done regarding the impact of latency arbitrage on the efficiency of securities markets. See id. Many of these studies have suggested that latency arbitrage exacts a "tax" on liquidity provision that dissuades liquidity providers from displaying large aggressively priced orders for fear of their stale orders being taken by latency arbitrageurs before the liquidity providers have had the chance to adjust such orders when reacting to the same market data. See Eric Budish, Comment letter regarding "Investors' Exchange LLC Form 1 Application (Release No. 34-75925; File No. 10-222)" dated February 5, 2016 ("Budish Letter").

4 The Exchange notes that while LTAD is designed to neutralize microsecond speed advantages, liquidity providers would still be required to obtain speed capabilities fast enough to take advantage of the LTAD.

5 "New incoming orders" are orders received by the Matching System for the first time. As discussed below, LTAD will not apply to other situations where existing orders or portions thereof are treated as incoming orders, such as (1) resting orders that are price slid into a new price point pursuant to the CHX Only Price Sliding or Limit Up-Limit Down Price Sliding Processes and (2) unexecuted remainders of routed orders released into the Matching System. See CHX Article 1, Rule 2(b)(1)(C); see also CHX Article 20, Rule 2A(b); see also CHX Article 20, Rule 8(b)(7). Incidentally, the Exchange is

against one or more resting orders on the CHX book, as well as certain related cancel messages, to be intentionally delayed for 350 microseconds before such delayed messages would be processed[7] by the Matching System.[8] [9] All other messages, including liquidity providing orders (i.e., orders that would not immediately execute against resting orders) and cancel messages for resting orders, would be immediately processed without delay. LTAD will not delay any outbound messages or market data.

LTAD is a direct response to recent declines in CHX volume and liquidity in the SPDR S&P 500 trust exchange-traded fund ("SPY"),[10] which the Exchange attributes to latency

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proposing to amend CHX Article 20, Rule 8(a)(7), which describes how unexecuted remainders of routed orders are handled by the Matching System, to delete the word "new" from the last sentence, so that the rule provides, in pertinent part, that if no balance exists at the time a part of an unexecuted remainder of a routed order is returned to the Matching System, it shall be treated an incoming order.

6 See CHX Article 1, Rule 1(qq) defining "Open Trading State."

7 For ease of reference, "processed" means executing instructions contained in a message, including, but not limited to, permitting an order to execute within the Matching System pursuant to the terms of the order or cancelling an existing order, whereas "evaluate" means the Matching System determining whether a message should be diverted into LTAD, as described below.

8 The Matching System is an automated order execution system, which is a part of the Exchange's "Trading Facilities," as defined under CHX Article 1, Rule 1(z).

9 As discussed below, the Exchange submits that LTAD is a de minimis intentional access delay in that it is so short as to not frustrate the purposes of Rule 611 of Regulation NMS by impairing fair and efficient access to an exchange's quotations. See Securities Exchange Act Release No. 78102 (June 17, 2016), 81 FR 40785 (June 23, 2016) ("Final Interpretation"). Thus, the Exchange's quotations would continue to be "immediately" accessible and protected pursuant to Rule 611. See 17 CFR 242.600(b)(3) defining "automated quotation"; see also 17 CFR 242.600(b)(58) defining "protected quotation"; see also infra Section 3(b).

10 The Exchange believes that much of the CHX liquidity in SPY and other S&P 500-correlated securities is provided as part of an arbitrage strategy between CHX and the futures markets, whereby liquidity providers utilize, among other things, proprietary algorithms to price and size resting orders on CHX to track index market data from a derivatives market (e.g., E-Mini S&P traded on the Chicago Mercantile Exchange's Globex trading platform). As such, an exchange could not make related adjustments to

arbitrage activity in SPY first observed at CHX in January 2016 ("SPY latency arbitrage activity").[11] Specifically, based on its review of unusual messaging patterns in SPY during the relevant period, corroborating Participant feedback and analysis of market data,[12] the Exchange believes that SPY latency arbitrage has caused CHX liquidity providers to dramatically reduce displayed liquidity in SPY (and at times withdraw from the market altogether), which, given CHX's significant contribution to overall volume and liquidity in SPY prior to the declines,[13] materially decreased liquidity in SPY marketwide, as discussed below.[14]

The Exchange believes that the best way to minimize the effectiveness of latency arbitrage strategies on CHX with respect to resting limit orders is to implement an asymmetric delay, such as LTAD, to deemphasize speed as a key to trading success.[15] By delaying liquidity taking orders, and not delaying liquidity providing orders and related adjustment messages,

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these special orders on behalf of liquidity providers pursuant to an order type, such as pegged orders benchmarked to the NBBO. Compare infra note 16.

11 As discussed in detail under Appendix A below, prior to the beginning of the SPY latency arbitrage activity in January 2016, CHX volume and liquidity in SPY constituted a material portion of overall volume and liquidity in SPY marketwide. For example, the CHX Market Share in SPY as a percentage of Total Volume decreased from 5.73% in January 2016 to 0.57% in July 2016, while the Control Securities did not experience similar declines. See infra note 12; see also infra Appendix A; see also infra Appendix B Calculation Set 1a. Also, the Time-weighted Average CHX Size At The NBBO in SPY relative to the total NMS Size At The NBBO in SPY decreased from 44.36% in January 2016 to 3.39% of the total NMS Size At The NBBO in SPY in July 2016, while the Control Securities did not experience similar declines. See infra note 12; see also infra Appendix A; see also infra Appendix B Calculations Sets 3a and 4a.

12 A detailed analysis ("CHX ETF Analysis") of the impact of latency arbitrage on displayed liquidity in SPY at CHX, for the period of August 2015 through July 2016 ("Analysis Period"), may be found under Appendix A. The market data utilized by the CHX ETF Analysis, as well as defined terms and notes, may be found under Appendix B.

13 See supra note 11.

14 See infra Appendix A.

15 See Mary Jo White, Chair, Securities and Exchange Commission, Speech at Sandler O'Neil & Partners L.P. Global Exchange and Brokerage Conference (June 5, 2014).

LTAD would give liquidity providers a small amount of additional time, the same length as the Investors Exchange LLC ("IEX") POP/coil delay ("IEX Delay") recently approved by the Commission,[16] to cancel or adjust resting orders on the CHX book to comport to the most recent market data before latency arbitrageurs could take such orders at potentially "stale" prices.[17] As the Commission noted in the IEX Approval Order, a symmetric delay that delays all inbound messages, such as the IEX Delay, would be ineffective in protecting resting limit orders from latency arbitrage.[18] Thus, the Exchange believes that LTAD will enhance displayed liquidity and price discovery in NMS securities without adversely affecting the ability of virtually all market participants, other than latency arbitrageurs, to access liquidity at CHX.[19]

Additionally, the Exchange notes that adopting a symmetric delay and order types that would permit the Exchange to reprice resting orders based on undelayed market data (e.g., pegged orders), such as the IEX Delay, would not be practical in addressing latency arbitrage with respect to limit orders because the liquidity provision strategies utilized by CHX liquidity

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16 See Securities Exchange Act Release No. 78101 (June 17, 2016), 81 FR 41141 (June 23, 2016) ("IEX Approval Order"). Unlike LTAD, the IEX Delay will delay all inbound order-related messages from IEX Users, outbound message confirmations to IEX Users, and outbound market data disseminated through IEX's proprietary data feed. See IEX Approval Order at 41154. By not delaying inbound market data, IEX would be able to reprice its resting pegged orders to track changes to the NBBO before latency arbitrageurs could execute against such pegged orders at potentially stale prices, which facilitates the ability of IEX to comply with its rules regarding the repricing of pegged orders. See IEX Approval Order at 41155.

17 In discussing possible alternatives to a frequent batch auction model for trading securities, the Budish Paper provides that "the asymmetric delay eliminates sniping and stops the arms race." See Budish Paper at 1612.

18 See IEX Approval Order, supra note 16, at 41157.

19 Based on the Exchange's analysis of cancel activity in SPY at CHX for the period starting in May 2016 through July 2016, the Exchange believes that if LTAD had been implemented during that time period, out of a total of 18,316 partially-executed orders in SPY, 20 liquidity taking orders not attributed to latency arbitrage activity would have not been executed, a de minimis number in the light of the enhanced liquidity and price discovery afforded by LTAD. See infra Appendix C.

providers in SPY, which provide valuable liquidity to the market overall,[20] require cancellations or adjustments to resting limit orders pursuant to proprietary algorithms held by the CHX liquidity providers that could not be adequately replicated by CHX.[21]

In light of the above, the Exchange submits that the proposed rules for LTAD are designed to operate in a manner that is consistent with the Act in that they are designed to protect investors and the public interest, are not designed to permit unfair discrimination, and would not impose any unnecessary or inappropriate burden on competition.[22] The Exchange now proposes the following amendments to the CHX Rules to implement LTAD.

Amended Article 20, Rule 8 (Operation of the CHX Matching System)

Proposed Article 20, Rule 8(h) provides rules that comprehensively describe LTAD. Specifically, proposed paragraph (h) begins by stating that after initial receipt[23] of a new incoming message, the Matching System will evaluate[24] the message to determine whether it is a "delayable message," as defined under proposed paragraph (h)(1) below. For the purposes of such an evaluation only, the Matching System shall not consider Match Trade Prevention ("MTP"), as described under current Article 1, Rule 2(b)(3)(F).[25] If not delayable, the Matching

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20 See supra note 12; see also infra Appendices A and B.

21 See supra note 10.

22 See infra Section 3(b).

23 As used herein, "initial receipt" means the time at which the Exchange receives a message and assigns the message a unique sequence number, which the Exchange utilizes to determine, among other things, message processing order and ranking on the CHX book. See CHX Article 20, Rule 8(b).

24 See supra note 7.

25 The purpose of ignoring MTP in LTAD evaluation is to provide a previously delayed order that would not have triggered MTP an opportunity to execute against the resting order before the newer incoming order would cancel the resting order after release from LTAD. The Exchange is proposing unrelated modifications to MTP to contemplate LTAD, as discussed below.

System will immediately process the message without delay. Proposed paragraph (h)(1) defines "delayable message" and provides that delayable messages shall only include the following:

(A) New incoming orders received during the Open Trading State[26] that would take liquidity from the CHX book.

(B) Cancel and cancel/replace messages for delayed orders that have not yet been released from LTAD.[27]

(C) The replace portion of a cancel/replace message where the cancel portion cancels a resting order and the replace portion would take liquidity from the CHX book.

The Exchange notes that the purpose of delaying the aforementioned cancel and cancel/replace messages is to minimize gaming opportunities by requiring the delayed order to interact with the CHX book before it is eligible for cancellation.

Mechanically, upon initial receipt of a new incoming message, the Matching System would assign the message a unique sequence number, as it does currently, which, in addition to establishing processing and execution priority, will serve as the starting point for the Fixed LTAD Period, as described below. The Matching System would then initially evaluate the message to determine whether it is a delayable message.[28] For example, a new incoming limit

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[26] The Exchange notes that LTAD would not apply during a SNAP Cycle, as described under CHX Article 18, Rule 1, as orders are not immediately executable at that time.

[27] As noted later under proposed paragraph (h), a delayed message may only be delayed once and, thus, the replace portion of a delayed cancel/replace message shall not be diverted into LTAD upon release in the event that it would take liquidity from the CHX book.

[28] The Exchange notes that the Matching System processes messages for a given security serially. Thus, the length of time it takes for a message to be evaluated and/or processed by the Matching System after initial receipt is herein called "variable message queuing delay," as the actual length of the delay depends on the number of precedent messages that have yet to be evaluated and/or processed by the Matching System and are residing

order marked Post Only[29] that could not take liquidity from the CHX book would not be a delayable message because it could not immediately execute against one or more resting orders on the CHX book. In such a case, the undelayed Post Only order would be immediately cancelled by the Matching System if it would immediately match with a resting order. Similarly, a new incoming order marked CHX Only[30] that would trade-through a protected quotation of an external market would not be a delayable message as it would be price slid to a permissible price.[31] However, a new incoming order that could immediately execute against a resting order, but for the fact that MTP would be triggered and prevent a match, would be considered a delayable message, as MTP is ignored for the purposes of LTAD evaluation only.[32]

Proposed paragraph (h) continues by providing that if a message is delayable, the message will be diverted into the LTAD queue and will remain delayed until it is released for processing. A delayed message shall become releasable 350 microseconds after initial receipt by the Exchange ("Fixed LTAD Period"),[33] but shall only be processed after the Matching System has evaluated and processed, if applicable,[34] all messages in the security received by the Exchange during the Fixed LTAD Period for the delayed message. Thus, a message may be

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in the "Inbound Queue." The length of time it takes for a message to be evaluated and/or processed by the Matching System is herein called "system-processing delay."

29 See CHX Article 1, Rule 2(b)(1)(D) defining "Post Only."

30 See CHX Article 1, Rule 2(b)(1)(C) defining "CHX Only."

31 See CHX Article 20, Rule 5(a)(2).

32 See supra note 25.

33 In the event that then-current messaging volume results in a delayable message being evaluated after 350 microseconds from initial receipt, the delayable message shall be diverted into LTAD and be immediately releasable. This will ensure that messages received during the Fixed LTAD Period for a delayed message are evaluated and processed, if applicable, before the delayable message is released.

34 For example, an order that could not take liquidity from the CHX book would not be delayed and would be immediately processed, whereas an order that could take liquidity from the CHX book would be delayed and would not be immediately processed.

delayed for longer than the Fixed LTAD Period depending on the then-current messaging volume in the security.[35] The Matching System will utilize a new market snapshot to process a released order.[36] Also, a delayed message shall retain its original sequence number and may only be delayed once. In addition, LTAD shall apply to all delayable messages submitted by any Participant for a security traded on the Exchange that is subject to LTAD. The Exchange may activate or deactivate LTAD per security with notice to Participants.[37]

The Exchange also proposes to make corresponding amendments to current Article 20, Rule 8(d) and (f) to contemplate LTAD. Specifically, the Exchange proposes to add the clause "subject to paragraph (h) below" at the end of current paragraph (d)(1) so that amended paragraph (d)(1) provides as follows:

> Except for certain orders which shall be executed as described in Rule 8(e), below, an incoming order shall be matched against one or more resting orders in the Matching System, in the order in which the resting orders are ranked on the CHX book, pursuant to Rule 8(b) above, at the Working Price of each resting order, as defined under Article 1,

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35 In the event a releasable message is awaiting other messages received during its Fixed LTAD Period to be evaluated and processed, if applicable, the releasable message would be subject to an additional unintentional variable delay that is a function of the then-current messaging volume in the security. See supra note 28; see also supra note 33; see also infra Examples 1-3.

36 The purpose of a new market snapshot is to ensure that the released order is processed in a manner consistent with federal securities rules and regulations, such as Regulation NMS and Regulation SHO.

37 As of the date of this filing, the Exchange anticipates applying LTAD to all securities traded on CHX. In the event the Exchange decides to activate or deactivate LTAD for certain securities, the Exchange will communicate the list of securities for which LTAD will be applied and/or the securities for which LTAD will not be applied, as well as the effective date(s) of such change(s), through a Customer Service Notification. Any change to the list of LTAD securities shall not be effective prior to the trading day following the date of the Customer Service Notification and shall only be effective as of the beginning of the relevant trading day.

Rule 1(pp), for the full amount of shares available at that price, or for the size of the incoming order, if smaller; subject to paragraph (h) below.

The Exchange also proposes to adopt paragraph (f)(3) to provide that certain cancel messages for an order in LTAD shall be handled as described under proposed paragraph (h). Incidentally, the Exchange proposes to replace the semi-colon and the word "and" at the end of current paragraph (f)(1) with a period.

Moreover, proposed paragraph (h)(2) describes how LTAD would interact with the Exchange's current order routing protocol and provides that the portion of a Routable Order[38] that is to be routed away, pursuant to current Article 19, Rule 3(a), shall be immediately routed without delay; provided that the entire unrouted balance of the Routable Order will be diverted into LTAD upon reaching the price point at which the unrouted balance of the Routable Order would become a delayable message (i.e., would take liquidity from the CHX book), pursuant to proposed paragraph (h)(1)(A).

Currently, the Exchange determines where and how to route an order on a price point-by-price point basis.[39] That is, the Exchange does not aggregate all protected quotations and resting liquidity through multiple price points in making a single order routing decision.[40] Thus, to the extent that an incoming order could take liquidity from the CHX book at a price worse than an away protected quotation (e.g., incoming sell order at $10.00/share; CHX Best Bid at $10.00/share and NBB at $10.01/share), the Matching System would not consider the fact that the incoming order could take liquidity from the CHX book at the time the Matching System is

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38 See CHX Article 1, Rule 1(oo).

39 See Exchange Act Release No. 74487 (March 12, 2015), 80 FR 14193 (March 18, 2015) (SR-CHX-2015-02).

40 See id.

evaluating the better priced protected quotation. As such, LTAD may result in a portion of a Routable Order being immediately routed away and the unrouted remainder being delayed.

Amended Routing Protocol

In light of the possible bifurcation of a Routable Order into an immediately routed portion and a delayed unrouted portion and the fact that the Exchange does not currently utilize any Router Feedback[41] to augment protected quotations,[42] LTAD could result in a single order being routed twice to satisfy the same protected quotation. In order to eliminate this inefficiency, the Exchange proposes to amend its current order routing protocol to adopt a single type of Router Feedback called Immediate Feedback to be applied on an order-by-order basis only.[43]

Specifically, Immediate Feedback would permit the Exchange's Routing System to decrease the number of shares available at an away market by an amount equal to the size of the immediately routed portion of the Routable Order, on an order-by-order basis, with such

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41 "Router Feedback" refers to the use of routed orders ("Feedback Orders") to augment protected quotations for the purposes of calculating the NBBO. See Securities Exchange Act Release No. 74075 (January 15, 2015), 80 FR 3693 (January 23, 2015) (SR-BYX-2015-03).

42 The consolidated market data disseminated by the securities information processors ("SIPs") are the only market data feeds utilized by the Exchange for the handling, execution and routing of orders, as well as for the regulatory compliance processes related to those functions. See CHX Article 1, Rule 4. Also, the Exchange does not currently ignore or modify SIP quote data for away markets under any circumstances where the SIP data feed shows an uncrossed market. See Exchange Act Release No. 74357 (February 24, 2015), 80 FR 11252 (March 2, 2015) (SR-CHX-2015-01); see also Securities Exchange Act Release No. 72711 (July 29, 2014), 79 FR 45570 (August 5, 2014) (SR-CHX-2014-10).

43 Bats BYX utilizes three different types of Router Feedback in its calculation of the NBBO, which includes Immediate Feedback, which is described as follows: "Where BATS Trading routes an order to a venue with a protected quotation using Smart Order Routing (a "Feedback Order"), the number of shares available at that the venue is immediately decreased by the number of shares routed to the venue at the applicable price level." See SR-BYX-2015-03, supra note 41, at 3695. Also, all Feedback expires as soon as: (i) one second passes; (ii) the exchange receives new quote information; or (iii) the exchange receives updated Feedback information. See id.

feedback expiring as soon as: (i) one second passes or (ii) the Exchange receives new quote information from the away market.[44] This would permit the Exchange to utilize Immediate Feedback to ignore the protected quotation to which the immediately routed portion was routed when the unrouted delayed portion is released from LTAD, thereby preventing double routing to satisfy the same protected quotation.[45]

Examples 1 – 3 illustrate the operation of LTAD. Examples 3 and 4 illustrate the operation of the proposed amended routing protocol.

Amended Article 1, Rule 2(b)(3)(F) (Match Trade Prevention)

Current Article 1, Rule 2(b)(3)(F) describes the MTP modifier, which prevents matches between orders that originate from the same MTP Trading Group or MTP sublevel thereunder.[46] Also, an order sender must designate one of the following MTP Actions for each order, with the MTP Action noted on the incoming order controlling the MTP interaction:

> MTP Cancel Incoming ("N"): An incoming limit or market order marked "N" will not execute against opposite side resting interest originating from the same MTP Trading Group or MTP sublevel, if applicable. Only the incoming order will be cancelled pursuant to MTP.
>
> MTP Cancel Resting ("O"): An incoming limit or market order marked "O" will not execute against opposite side resting interest originating from the same MTP Trading

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44 Given the length of the Fixed LTAD Period, the Exchange notes that it is unlikely that Immediate Feedback would expire due to one second passing without new quote information.

45 Given the length of the Fixed LTAD Period, it is unlikely that the Exchange would receive a confirmation from the away market prior to the unrouted delayed portion being released from LTAD.

46 See Securities Exchange Act Release No. 71216 (December 31, 2013), 79 FR 883 (January 7, 2014) (SR-CHX-2013-23); see also Securities Exchange Act Release No. 70948 (November 26, 2013), 78 FR 72731 (December 3, 2013) (SR-CHX-2013-20).

Group or MTP sublevel, if applicable. Only the resting order will be cancelled pursuant to MTP.

MTP Cancel Both ("B"): An incoming limit or market order marked "B" will not execute against opposite side resting interest originating from the same MTP Trading Group or MTP sublevel, if applicable. The entire size of both orders will be cancelled pursuant to MTP.

Given that LTAD may result in newer orders (i.e., orders with lower sequence numbers) becoming resting orders prior to older orders being released from LTAD,[47] the Exchange proposes to amend current Article 1, Rule 2(b)(3)(F)(iii)(a) and (b), which describe MTP Actions "N" and "O" respectively, to provide that the newer of the contra-side orders, as opposed to the incoming order if it is the older order, would be cancelled if the incoming order is marked "N," and the older of the contra-side orders, as opposed to the resting order if it is the newer order, would be cancelled if the incoming order is marked "O." Moreover, given that a price slid order that triggers MTP is not always the newer order[48] and because the Exchange wishes to maintain the current handling of MTP when it is triggered by a price slid order, the Exchange proposes to add clauses to the end of current subparagraphs (a) and (b) that preserve that current handling. Thus, amended subparagraphs (a) and (b) provide as follows:

(a) MTP Cancel New ("N"): An incoming limit or market order marked "N" will not execute against opposite side resting interest originating from the same MTP Trading Group or MTP sublevel, if applicable. Only the newer order will be cancelled pursuant to

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47 Currently, a new incoming order that triggers MTP is always newer than the resting contra-side order. However, LTAD may result in the newer of the contra-side orders being the resting order and the older order being the incoming order. See infra Example 5.

48 See Example 4 under SR-CHX-2013-20.

MTP; provided that the incoming order will be cancelled, even if it is not the newer order, in the event MTP is triggered by the incoming order being price slid pursuant to the CHX Only Price Sliding Processes.

(b) MTP Cancel Old ("O"): An incoming limit or market order marked "O" will not execute against opposite side resting interest originating from the same MTP Trading Group or MTP sublevel, if applicable. Only the older order will be cancelled pursuant to MTP; provided that the resting order will be cancelled, even if it is not the older order, in the event MTP is triggered by the incoming order being price slid pursuant to the CHX Only Price Sliding Processes.

Example 5 below illustrates how the amended MTP would operate in the context of LTAD.

Examples

The following Examples are illustrative of LTAD and related amendments to existing functionality, but do not exhaustively depict every possible scenario that may arise under LTAD. Moreover, the Examples do not necessarily depict the actual technical processes of prioritizing messages and executing orders.

Example 1: LTAD. Assume that LTAD is operational, all messages are for security XYZ and all orders are routable. Assume that the system-processing delay[49] is 50 microseconds.[50] Assume then at 9:59:59.999999, the NBBO is 10.00 x 10.01, the Inbound Queue and the LTAD queue are empty and the CHX book is as follows:

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49 See supra note 28.

50 The Exchange does not represent that actual system-processing delay is at or near 50 microseconds or that unintentional delays do not exist elsewhere in the Matching System processes. The figure is being utilized for demonstrative purposes only.

Fig 1a: CHX Book	
Buy	**Sell**
Empty	Order A: 1000 @10.01

Assume then that at 10:00:00.000000, the Exchange receives the following order:

Fig 1b: Inbound Queue	
Initial Receipt	**Message**
10:00:00.0000000	Order B: Buy 1000 @ 10.01

Under this Example 1, Order B would be immediately evaluated and diverted into LTAD because it is a delayable message as it could execute against Order A. Due to the system-processing delay, Order B would be diverted into LTAD at 10:00:00.000050 and releasable at 10:00:00.000350. The result is that the Inbound Queue would be empty and the LTAD queue would be as follows:

Fig 1c: LTAD Queue	
Releasable Time	**Message**
10:00:00.000350	Order B: Buy 1000 @ 10.01

Example 2: Execution Priority. Assume the same as Example 1 and the NBBO is still 10.00 x 10.01 with CHX being the only market at the NBO. Assume then that the Matching System receives the following new messages in security XYZ:

Fig 2a: Inbound Queue	
Initial Receipt	**Message**
10:00:00.000265	Cancel Order A
10:00:00.000305	Order C: Sell 1000 @ 10.02
10:00:00.000310	Order D: Buy 1000 @ 10.01
10:00:00.000325	Cancel Order B
10:00:00.000355	Order E: Sell 1000 @ 10.01

Under this Example 2:

- Cancel Order A would be evaluated and processed at 10:00:00.000265 without being diverted into LTAD as it would cancel a resting order and is not a delayable message. However, due to the system-processing delay, Order A would actually be cancelled at 10:00:00.000315 and the CHX book would become empty.
- Order C would then be evaluated at 10:00:00.000315, due to the variable message queuing delay,[51] and then immediately processed without being diverted into LTAD as it adds liquidity to the CHX book and it is not a delayable message. However, due to the system-processing delay, Order C would actually post to the CHX book at 10:00:00.000365 and the CHX book would be as follows:

Fig 2b: CHX Book	
Buy	**Sell**
Empty	Order C: 1000 @ 10.02

[51] See supra note 28.

- While Order C was being evaluated and processed by the Matching System, Order B became releasable from the LTAD queue at 10:00:00.000350. However, given that the Matching System processes messages serially,[52] the Matching System would not consider releasing Order B until after Order C had been processed at 10:00:00.000365, at which point it would be handled as follows:
    - At 10:00:00.000365, the Matching System would compare the releasable time of Order B to the initial receipt time of the message at the top of the Inbound Queue: Order D. Since Order D was received during the Fixed LTAD Period for Order B, Order D would be evaluated before releasing Order B and immediately processed without being diverted into LTAD as it adds liquidity to the CHX book and is not a delayable message. However, due to the system-processing delay, Order D would actually post to the CHX book at 10:00:00.000415. The result is that the NBBO would become 10.01 x 10.02 and the CHX book would be as follows:

Fig 2c: CHX Book	
Buy	**Sell**
Order D: 1000 @ 10.01	Order C: 1000 @ 10.02

    - At 10:00:00.000415, the Matching System would then compare the releasable time of Order B to the initial receipt time of the next message at the top of the Inbound Queue: Cancel Order B. Since Cancel Order B was received when Order B was in the LTAD queue, Cancel Order B would be diverted into LTAD as it is a cancel message for an order that has yet to be released from LTAD. However, due to the system-

[52] See id.

processing delay, Cancel Order B would be diverted into LTAD at 10:00:00.000465 and releasable at 10:00:00.000675. The result is that the LTAD queue would be as follows:

Fig 2d: LTAD Queue	
Releasable Time	**Message**
10:00:00.000350	Order B: Buy 1000 @ 10.01
10:00:00.000675	Cancel Order B

- At 10:00:00.000465, the Matching System would then compare the releasable time of Order B to the initial receipt time of the next message at the top of the Inbound Queue: Order E. However, given that Order E was received after the Fixed LTAD Period for Order B had expired, the Matching System would release Order B before evaluating Order E. Due to the system-processing delay, Order B would actually post to the CHX book at 10:00:00.000515. Also, given that Order B was initially received before Order D, Order B would receive execution priority over Order D, pursuant to Article 20, Rule 8(b)(1). The result is that the CHX book would be as follows:

Fig 2e: CHX Book	
Buy	**Sell**
Order B: 1000 @ 10.01	Order C: 1000 @ 10.02
Order D: 1000 @ 10.01	

- Order E would then be evaluated at 10:00:00.000515, due to the variable message queuing delay, and since it would execute against Order B, it would be diverted into LTAD at

10:00:00.000565, due to the system-processing delay, and releasable at 10:00:00.000705. The result is that the LTAD queue would be as follows:

Fig 2f: LTAD Queue	
Releasable Time	**Message**
10:00:00.000675	Cancel Order B
10:00:00.000705	Order E: Sell 1000 @ 10.01

- Cancel Order B would then be released from LTAD at 10:00:00.000675, as there are no messages received during its Fixed LTAD Period in the Inbound Queue. Thus, Cancel Order B would be processed and Order B would be cancelled at 10:00:00.000725, due to the system-processing delay. The result is that the CHX Book and the LTAD queue would be as follows:

Fig 2g: CHX Book	
Buy	**Sell**
Order D: 1000 @ 10.01	Order C: 1000 @ 10.02

Fig 2h: LTAD Queue	
Releasable Time	**Message**
10:00:00.000705	Order E: Sell 1000 @ 10.01

- Order E would then be released from LTAD at 10:00:00.000725, as the Matching System was processing Cancel Order B when Order E became releasable at 10:00:00.000705. Order E would then be processed and fully execute against Order D at $10.01/share at

10:00:00.000775, due to the system-processing delay. The result is that the Inbound Queue and the LTAD queue would be empty and the CHX Book would be as follows:

Fig 2h: CHX Book	
Buy	**Sell**
Empty	Order C: 1000 @ 10.02

Example 3: Post Only and Routing – Immediate Feedback. Assume the same as Example 2 and that the NBBO is 10.01 x 10.02 with only one market ("Away Market A_1") displaying 1,000 shares at the NBB ("Protected Bid A_1"). Assume also that there are no Protected Bids at $10.00. Assume then that the Matching System receives the following new messages in security XYZ:

Fig 3a: Inbound Queue	
Initial Receipt	**Message**
10:00:00.000800	Cancel Order C
10:00:00.001000	Order F: Buy 1000 @ 10.00
10:00:00.001010	Order G: Sell 2000 @ 9.99
10:00:00.001020	Order H: Sell 2000 @ 9.99
10:00:00.001030	Cancel Order F
10:00:00.001040	Order I: Post Only Buy 1000 @ 10.00

Under this Example 3:

- Cancel Order C would be evaluated at 10:00:00.000800 and then immediately processed without being diverted into LTAD as it would cancel a resting order and is not a

delayable message. However, due to the system-processing delay, Order C would actually be cancelled at 10:00:00.000850 resulting in the CHX Book becoming empty.

- Order F would then be evaluated and processed at 10:00:00.001000 without being diverted into LTAD as it would provide liquidity and is not a delayable message. However, due to the system-processing delay, Order F would actually post to the CHX book at 10:00:00.001050. The result is that the CHX Book would be as follows:

Fig 3b: CHX Book	
Buy	**Sell**
Order F: 1000 @ 10.00	Empty

- Order G would then be evaluated at 10:00:00.001050, due to variable message queuing delay. Pursuant to the Exchange's routing protocol, the Exchange would immediately route 1,000 shares of Order G priced at 10.01/share to satisfy Protected Bid A_1.[53] Moreover, since the unrouted 1000 shares of Order G could execute against Order F at 10.00, the unrouted 1000 shares of Order G would be diverted into LTAD at 10:00:00.001100, due to system-processing delay, and releasable at 10:00:00.001360. The result is that the LTAD queue would be as follows:

Fig 3c: LTAD Queue	
Releasable Time	**Message**
10:00:00.001360	Order G: Sell 1000 @ 9.99

[53] The Exchange notes that the time it takes for the Exchange to receive confirmation from the away market for a routed order is much longer than the proposed 350 microsecond LTAD. Thus, it is highly unlikely that the Exchange would receive an execution report from the away market before a delayed unrouted portion is released from LTAD. See supra notes 44 and 45.

- Order H would then be evaluated at 10:00:00.001100, due to variable message queuing delay. Given that Order H is virtually identical to Order G and that the proposed Immediate Feedback is only applied on an order-by-order basis, Order H would be handled exactly as Order G. Specifically, the Exchange would immediately route 1000 shares of Order H priced at 10.01/share to satisfy Protected Bid A_1. Moreover, since the unrouted 1000 shares of Order H could execute against Order F at 10.00, the unrouted 1000 shares of Order H would be diverted into LTAD at 10:00:00.001150, due to system-processing delay, and releasable at 10:00:00.001370. The result is that the LTAD queue would be as follows:

Fig 3d: LTAD Queue	
Releasable Time	**Message**
10:00:00.001360	Order G: Sell 1000 @ 9.99
10:00:00.001370	Order H: Sell 1000 @ 9.99

- Cancel Order F would then be evaluated at 10:00:00.001150, due to variable message queuing delay, but would be immediately processed without being diverted into LTAD as it would cancel a resting order and is not a delayable message. However, due to the system-processing delay, Order F would actually be cancelled at 10:00:00.001200. The result is that the CHX book would become empty.
- Order I would then be evaluated at 10:00:00.001200, due to variable message queuing delay, but would be immediately processed without being diverted into LTAD as it would provide liquidity and is not a delayable message. However, due to the system-processing

delay, Order I would actually post to the CHX book at 10:00:00.001250. The result is that the CHX book would be as follows:

Fig 3e: CHX Book	
Buy	**Sell**
Order I: Post Only 1000 @ 10.00	Empty

- Unrouted remainder of Order G would be released from LTAD at 10:00:00.001360, as all messages received during the Fixed LTAD Period for Order G have already been processed.[54] Thus, Order G would be processed and given the Immediate Feedback received from the routed portion of Order G and the fact that the Immediate Feedback had not expired, the unrouted remainder of Order G would fully execute against Order I at 10.00/share[55] at 10:00:00.001410, due to system-processing delay.[56] The result is that the CHX book would become empty.
- Unrouted remainder of Order H would be released from LTAD at 10:00:00.001410 as the Matching System was processing the unrouted remainder of Order G when the unrouted remainder of Order H became releasable at 10:00:00.001370. Thus, Order H would be processed and given the Immediate Feedback received from the routed portion of Order H and the fact that the Immediate Feedback had not expired, the unrouted remainder of Order H would post to the CHX book at 10:00:00.001460, due to system-processing delay. The result is that the CHX book would be as follows:

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54 See id.

55 See CHX Article 20, Rule 8(d)(1).

56 The Exchange notes that Order I would receive the liquidity provide credit and Order G would be charged the liquidity taking fee, pursuant to Section E.1 of the Fee Schedule of the Exchange, even though Order I was initially received after Order G.

Fig 3f: CHX Book	
Buy	**Sell**
Empty	Order H: 1000 at 9.99

Example 4: Routing – Expired Feedback. Assume the same as Example 3, except that immediately prior to the unrouted portion of Order G being released, the Exchange received an updated quote from Away Market A_1 displaying 1,000 shares at the $10.01.

Under this Example 4, the Immediate Feedback derived from the immediately routed portion of Order G would expire and, upon release of the unrouted delayed portion of Order G, the Matching System would route the entire unrouted portion to satisfy the updated Protected Bid displayed by Away Market A_1.

Similarly, the Immediate Feedback derived from the immediately routed portion of Order H would also expire and, upon release of the unrouted delayed portion of Order H, the Matching System would route the entire unrouted portion to satisfy the updated Protected Bid displayed by Away Market A_1.

Example 5: MTP. Assume the same as Example 3, except that Order G and Order I originated from the same MTP Trading Group and Order G has an MTP Action of "N."

Under this Example 5, pursuant to the current MTP rules, MTP would be triggered and the unrouted remainder of Order G would be cancelled, as the current "N" MTP Action requires the incoming order to be cancelled. However, pursuant to the proposed amended MTP rules, Order I would be cancelled, as the amended "N" MTP action requires the newer order to be cancelled, absent a price sliding event.

Operative Date

In the event the proposed rule change is approved by the SEC, the proposed rule change shall be operative pursuant to notice by the Exchange to its Participants. Prior to the operative date, the Exchange will ensure that policies and procedures are in place to allow Exchange operations personnel to effectively monitor the operation of LTAD.

Appendix A: CHX ETF Analysis

The purpose of the CHX ETF Analysis is to demonstrate that latency arbitrage activity[57] in SPY at CHX ("SPY latency arbitrage activity") has (1) reduced volume and displayed liquidity in SPY at CHX and (2) impaired liquidity provision in SPY marketwide. For the purpose of this CHX ETF Analysis, the following terms shall have the following meanings:[58]

- After Period refers to February 2016 through July 2016.
- Analysis Period refers to August 2015 through July 2016.
- Before Period refers to August 2015 through December 2015.
- Control Average refers to the arithmetic average of a given metric for Control Securities.
- Control Securities refers to DIA, IWM, and QQQ.[59]
- Entry Event refers to a trading day in January 2016 on which latency arbitrage activity in SPY at CHX was first observed.

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57 See supra note 3.

58 Other capitalized terms utilized in the CHX ETF Analysis shall have the meanings set forth under Appendix B.

59 Each of the Control Securities were selected for the following similarities to SPY in that each is: (1) highly correlated in price movements with a well-known equity market index; (2) ETFs; (3) traded in CHX's Chicago data center; (4) actively traded in the NMS; and (5) highly correlated with a futures contract traded electronically on the Globex trading platform.

- Entry Month refers to January 2016, the month in which latency arbitrage activity in SPY at CHX was first observed.
- Subject Securities refers to SPY and the Control Securities.

Entry of SPY Latency Arbitrage Activity

During the After Period, the Exchange observed unusual messaging patterns in SPY whereby executions of large inbound Immediate Or Cancel ("IOC")[60] orders against resting orders in SPY were frequently followed by the receipt of late cancel messages for the executed resting orders very soon after the execution. This observation was corroborated by feedback from liquidity providing Participants that indicated that, unlike prior to the Entry Event, they were no longer able to reliably cancel or cancel/adjust resting orders on the CHX book in SPY in response to market changes after the Entry Event. The Exchange believes that each instance of the unusual messaging pattern is the end result of a race triggered by an away market event (e.g., change in market data from a futures market) where the liquidity taker is able to take a resting order at a stale price before the liquidity provider could adjust the resting order to accurately reflect the market.[61] As such, the SPY latency arbitrage activity has had the following impact on volume and liquidity in SPY at CHX and away exchanges:

Analysis 1: SPY Latency Arbitrage Activity Reduced CHX Market Share in SPY Relative to Total Volume in SPY and Disproportionately to Control Securities

As shown under Figure 1, CHX Market Share in SPY as a percentage of Total Volume dropped by 90.1% from 5.73% in the Entry Month to 0.57% in July 2016, while CHX Market Share in the Control Average dropped by 45.20% from 5.54% in the Entry Month to 3.03% in

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60 See CHX Article 1, Rule 2(d)(4).

61 See supra note 10.

July 2016.[62] As shown under Figure 2, changes in the average Total Volume during the Analysis Period for the Subject Securities were highly correlated. Thus, Figure 1 and Figure 2 show that despite the high correlation between SPY and each of the Control Securities during the Analysis Period, the CHX Market Share in SPY decreased disproportionately to Total Volume, which the Exchange submits is attributed to the SPY latency arbitrage activity.

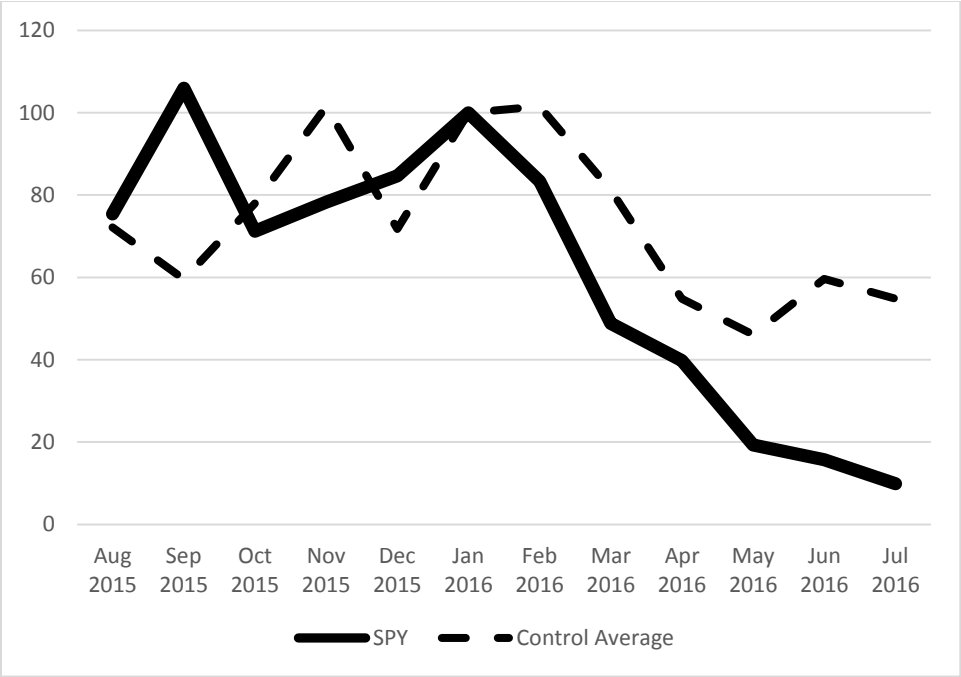

Figure 1. This figure illustrates the decrease in CHX Market Share as a percentage of Total Volume in the Subject Securities (Index: January 2016=100).[63]

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62 See infra Appendix B Calculation Set 1a.

63 See infra Appendix B Calculation Sets 1a and 1b.

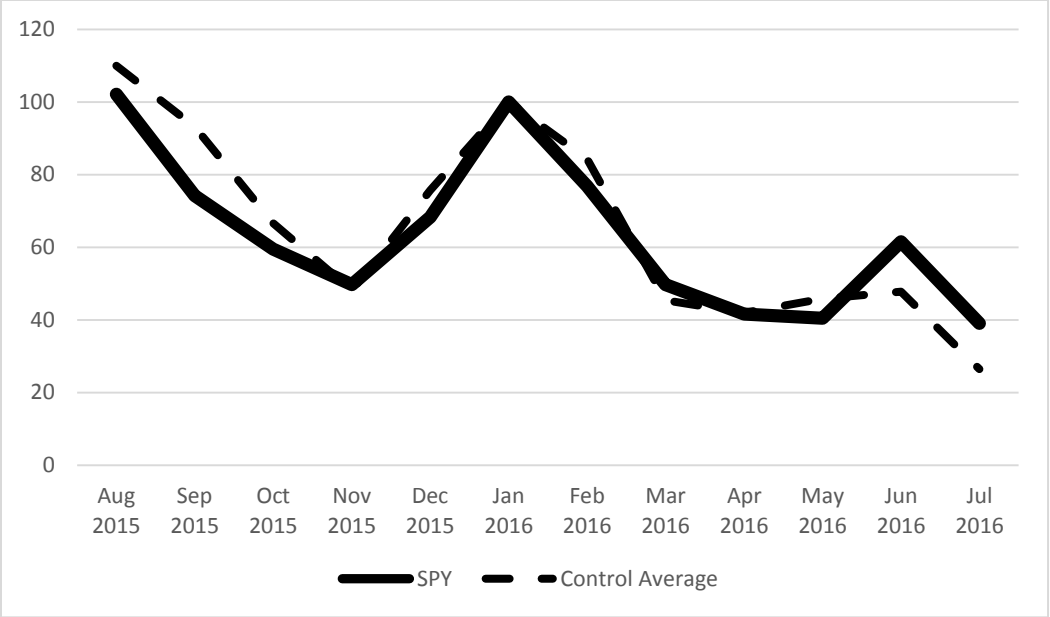

Figure 2. This figure illustrates the correlation in the Total Volume between SPY and the Control Average (Index: January 2016 = 100) during the Analysis Period.[64] [65]

Analysis 2: SPY Latency Arbitrage Activity Resulted in Less Aggressively Priced and Smaller Orders in SPY at CHX

While the Exchange did not observe any discernable change on the NBBO spread in SPY during the After Period, the Exchange did observe a negative impact on the frequency at which CHX was at the NBBO in SPY and the frequency at which CHX displayed the largest quote at the NBBO in SPY during the After Period, while Control Securities experienced either smaller declines or no declines at all.[66]

Specifically, the % of Time CHX Was At The NBB decreased from 23.8% in the Entry Month to 8.2% in July 2016;[67] the % of Time CHX Was At The NBO decreased from 23.3% in

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64 The correlation coefficients (ρ) over the twelve-month period were: ρ(SPY, DIA) = 0.9118, ρ(SPY, IWM) = 0.8996, ρ(SPY, QQQ) = 0.9392, ρ(SPY, Average) = 0.9493.

65 See infra Appendix B Calculation Sets 2a and 2b.

66 See infra Appendix B Calculation Sets 6 and 7.

67 See infra Appendix B Calculation Set 6a.

the Entry Month to 5.8% in July 2016;[68] and the % of Time CHX Was At The NBB and that CHX Was At The NBO decreased from 3.3% in the Entry Month to 0% in July 2016.[69]

Moreover, the % of Time CHX Was At The NBB And Was The Largest Bid At That Price decreased from 20% in the Entry Month to 2.3% in July 2016;[70] the % of Time CHX Was At The NBO And Was The Largest Offer At That Price decreased from 20.7% in the Entry Month to 1.1% in July 2016;[71] and the % of Time CHX Was At The NBB And Was The Largest Bid At That Price and that CHX Was At The NBO And Was The Largest Offer At That Price decreased from 1.9% to 0%.[72]

These calculation sets clearly show that SPY latency arbitrage activity resulted in less aggressively priced CHX displayed liquidity in SPY and smaller CHX displayed size at the NBBO, during the After Period. SPY latency arbitrage also negatively impacted the percentage of the time that CHX was at the NBBO and the percentage of the time CHX displayed the largest quote at the NBBO.

Analysis 3: Latency Arbitrage Activity at CHX Reduced CHX Size At The NBBO in SPY Relative to the Control Securities and NMS Size At The NBBO

As shown under Figure 3, during the Before Period, the Time-weighted Average CHX Size at The NBBO for SPY tended to follow changes to the Control Average, whereas from the Entry Month through July 2016, the Time-weighted Average CHX Size At The NBBO for SPY decreased by 82.16% and the Time-weighted Average CHX Size At The NBBO for the Control

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68 See infra Appendix B Calculation Set 6b.

69 See infra Appendix B Calculation Set 6c.

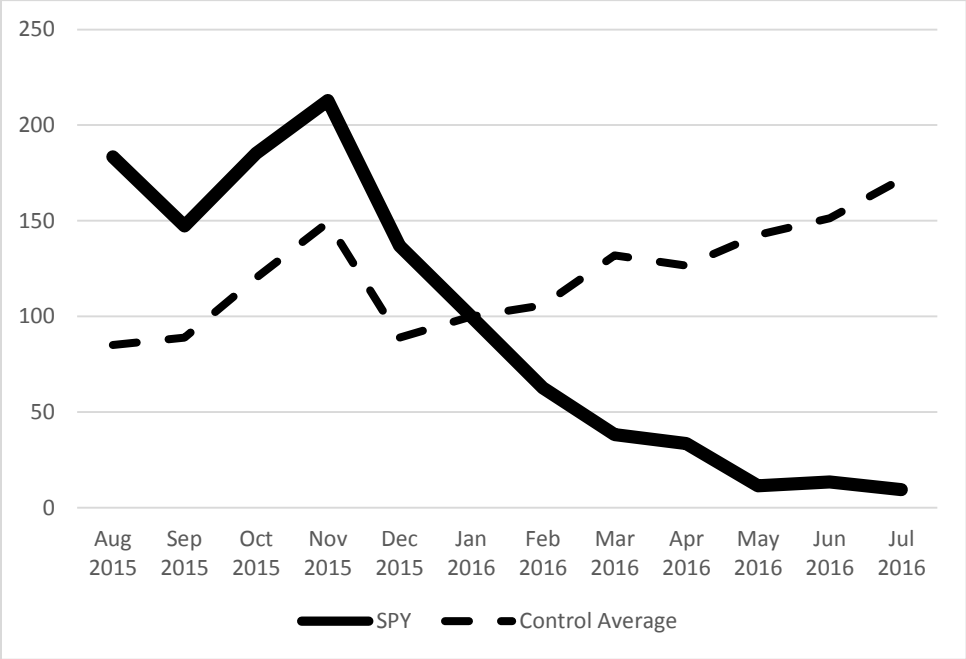
70 See infra Appendix B Calculation Set 7a.

71 See infra Appendix B Calculation Set 7b.

72 See infra Appendix B Calculation Set 7c.

Average increased by 64.38%.[73] As shown under Figure 4, during the Before Period, the monthly changes in the Time-weighted Average CHX Size At The NBBO tended to follow similar changes to the Time-weighted Average NMS Size At The NBBO. However, during the After Period, the monthly changes in the Time-weighted Average CHX Size At The NBBO in SPY did not follow changes to the Time-weighted Average NMS Size At The NBBO in SPY. Moreover, during the After Period, CHX went from having a Two-Sided Market in SPY 100% of regular trading hours in the Entry Month to 74% of regular trading hours in July 2016.[74]

Thus, Figure 3 and Figure 4 show that SPY latency arbitrage negatively impacted liquidity in SPY marketwide. Moreover, the data shows that the change in the risk/reward of providing liquidity in SPY at CHX which resulted from the introduction of the SPY latency arbitrage activity resulted in a significant reduction of liquidity in SPY provided by CHX, even during a period when significant incremental liquidity was being added in the Control Securities.



73 See infra Appendix B Calculation Sets 3a and 3b.

74 See infra Appendix B Calculation Set 5.

Figure 3. This figure illustrates the Time-weighted Average CHX Size At The NBBO in the Subject Securities (Indexed: January 2016 = 100) during the Analysis Period.[75]

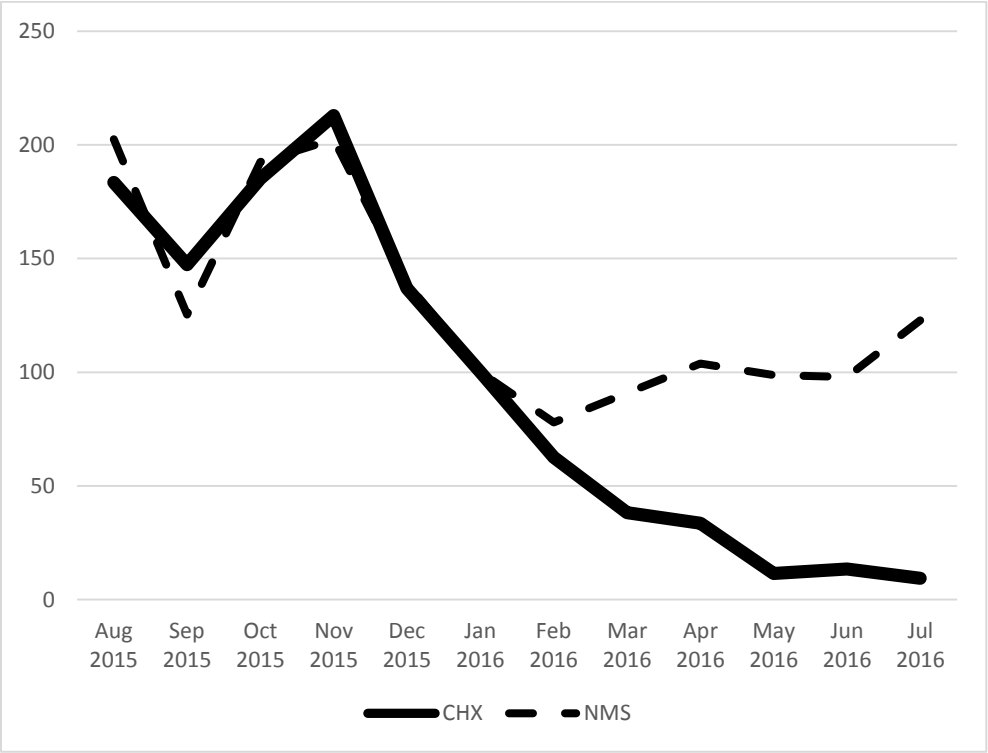


Figure 4. This figure illustrates the Time-weighted Average CHX Size At The NBBO in SPY versus Time-weighted Average NMS Size At The NBBO in SPY (Indexed: January 2016 = 100) during the Analysis Period.[76]

Analysis 4: SPY Latency Arbitrage Activity Reduced Displayed Liquidity in SPY Marketwide

Although the Time-weighted Average NMS Size At The NBBO in SPY increased by 22.83% during the After Period, the increase in SPY did not follow much greater increases in the

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75 See infra Appendix B Calculation Sets 3a and 3b.

76 See infra Appendix B Calculation Sets 3b and 4b.

Time-weighted Average NBBO Size in the Control Group, which increased by 128.82% during the After Period.[77] Moreover, during the After Period, the Time-weighted Average CHX Size At The NBBO for SPY decreased by 90.61%[78] and, as a % of total NMS Size At The NBBO in SPY, from 44.36% to 3.39%.[79] These calculations suggest that the SPY latency arbitrage activity materially impacted displayed liquidity in SPY marketwide. The dramatic decrease in displayed liquidity in SPY at CHX during the After Period explains why the increase in Time-weighted Average NBBO Size in SPY lagged behind the increase in Time-weighted Average NBBO Size in the Control Securities. Had CHX Size At The NBBO remained at least constant during the After Period, NBBO Size in SPY would have been at least 32.7% higher in July 2016, as shown below:[80]

	NMS Size at NBBO			**Change Attribution**	
	Jan-16	**Jul-16**	**Change**	**CHX**	**Others**
SPY	9,513	11,686	2,172	-3,824	5,996
DIA	2,569	4,711	2,142	1,227	915
IWM	5,222	10,026	4,804	536	4,268
QQQ	14,100	35,354	21,253	3,900	17,353
Control Average	7,297	16,697	9,400	1,888	7,512

77 See infra Appendix B Calculation Set 4a.

78 See infra Appendix B Calculation Set 3a.

79 See infra Appendix B Calculations Sets 3a and 4a.

80 See infra Appendix B Calculation Set 4a.

Conclusion

Based on its observations of unusual messaging patterns in SPY, feedback from Participants and the analysis summarized above, the Exchange believes that the unusual messaging activity in SPY that was first observed in the Entry Month is attributed to SPY latency arbitrage activity. The market data shows that in response to the SPY latency arbitrage activity, CHX liquidity providers displayed smaller orders in SPY at less aggressive prices during the After Period relative to the Before Period and Entry Month. Moreover, in light of CHX's significant contribution to overall volume and liquidity in SPY during the Before Period and the Entry Month, diminished displayed liquidity at CHX has materially impaired displayed liquidity in SPY marketwide.

Appendix B: Calculation Sets

The calculations sets below were prepared with microsecond-level trade and quote record. Trade records include the date, microsecond-level timestamp, exchange, security symbol, price, and quantity of all trades reported to the consolidated tape. Quote records include the date, microsecond-level timestamp, exchange, security symbol, bid price, bid quantity, ask price, and ask quantity of all quotes reported to the consolidated tape. Only protected quotations are reported to the consolidated tape.

The Analysis Period for the calculations begins on August 1, 2015 and ends on July 31, 2016. Symbols SPY and three other Control Securities (i.e., DIA, IWM, and QQQ) were considered. Only trades and quotes that occurred on the national securities exchanges during the regular trading hours[81] were considered. Certain types of non-standard trades were excluded.[82]

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81 See 17 CFR 242.600(b)(64).

82 Non-standard trades include derivatively priced trades, qualified contingent trades, opening trades, closing trades, and after hours trades.

Quotes with negative prices or quantities were excluded. Unless otherwise indicated, lengths of time when the market was locked or crossed were not considered.

In the calculations below:

- Total Volume refers to the number of shares of the indicated symbol traded on the national securities exchanges on a given day, excluding certain types of non-standard trades. CHX Volume refers to the number of shares of the indicated symbol traded on CHX on a given day, excluding certain types of non-standard trades.
- CHX Market Share was calculated as CHX Volume divided by Total Volume on a given day, CHX Market Share = CHX Volume ÷ Total Volume.
- CHX Had A Two-Sided Market refers to an indicator variable defined as true at any microsecond when there was at least one bid and at least one offer among all outstanding orders on CHX, and false otherwise. CHX Had A One-Sided Market refers to an indicator variable defined as true at any microsecond when there was at least one bid but no offers among all outstanding orders on CHX or when there was at least one offer but no bids among all outstanding orders on CHX, and false otherwise. CHX Had No Market refers to an indicator variable defined as true at any microsecond when there were no outstanding orders on CHX, and false otherwise.
- A bid was At The NBB at any microsecond when its price was equal to the National Best Bid. An offer was At The NBO at any microsecond when its price was equal to the National Best Offer.
- At any microsecond, the NMS Size At The National Best Bid ("NMS Size At The NBB") refers to the quantity of shares in prevailing bids on the national securities exchanges priced at the National Best Bid and the NMS Size At The National Best Offer ("NMS

Size At The NBO") refers to the quantity of shares in prevailing offers on the national securities exchanges priced at the National Best Offer. NMS Size At The NBBO was calculated as the average of the National Best Bid Size and the National Best Offer Size at each microsecond, NMS Size At The NBBO = (NMS Size At The NBB + NMS Size At The NBO) ÷ 2.

- CHX Was At The NBB refers to an indicator variable defined as true at any microsecond when the CHX Best Bid was at the National Best Bid, and false otherwise. CHX Was At The NBO refers to an indicator variable defined as true at any microsecond when the CHX Best Offer was at the National Best Offer, and false otherwise.
- At any microsecond, the CHX Size At The NBB ("CHX Size At The NBB") refers to the CHX Best Bid Size if CHX was at the NBB and zero if CHX was not at the NBB. At any microsecond, the CHX Size At The NBO ("CHX Size At The NBO") refers to the CHX Best Offer Size if CHX was at the NBO and zero if CHX was not at the NBO. CHX Size At The NBBO was calculated as the average of the CHX Size At The NBB and CHX Size At The NBO at each microsecond, CHX Size At The NBBO = (CHX Size At The NBB + CHX Size At The NBO) ÷ 2.
- CHX Was At The NBB And Was The Largest Bid At That Price refers to an indicator variable defined as true at any microsecond when CHX was at the National Best Bid and the CHX Best Bid Size was greater than or equal to the largest quantity of shares in prevailing bids on any one national securities exchange other than CHX, and false otherwise. CHX Was At The NBO And Was The Largest Offer At That Price refers to an indicator variable defined as true at any microsecond when CHX was at the National Best Offer and the CHX Best Offer Size was greater than or equal to the largest quantity of

shares in prevailing offers on any one national securities exchange other than CHX, and false otherwise.

For the calculations in the table below:

- Monthly average values are shown. Monthly average values were calculated as the average of daily values for each day in a month. Daily values were calculated as time-weighted averages or as percentages of time in the trading day, as indicated in the table. Time-weighted average values were calculated as daily average of the specified quantity, market share, or spread value weighted by time (in microseconds). % of time values were calculated as the length of time (in microseconds) for which the specified indicator variable was true divided by the length of time in that trading day, excluding lengths of time during which the market was locked or crossed or otherwise could not be calculated (e.g., at the start of the trading day).

			Symbol				
			SPY	**DIA**	**IWM**	**QQQ**	**Control Average**
No.	**Calculation**	**Month**	**[1]**	**[2]**	**[3]**	**[4]**	**([2]:[4])**
[1a]	CHX Market Share (% of Total Volume)	Aug 2015	4.32%	3.07%	5.51%	3.40%	3.99%
		Sep 2015	6.07%	2.61%	3.82%	3.46%	3.30%
		Oct 2015	4.08%	5.95%	2.58%	4.42%	4.32%
		Nov 2015	4.49%	8.58%	3.14%	5.13%	5.62%
		Dec 2015	4.85%	4.89%	2.53%	4.49%	3.97%
		Jan 2016	5.73%	9.13%	3.14%	4.35%	5.54%
		Feb 2016	4.78%	9.13%	3.32%	4.41%	5.62%
		Mar 2016	2.80%	7.54%	2.38%	3.57%	4.50%
		Apr 2016	2.28%	4.41%	2.01%	2.69%	3.04%
		May 2016	1.10%	3.53%	2.21%	1.93%	2.55%
		Jun 2016	0.90%	5.17%	1.74%	3.00%	3.30%
		Jul 2016	0.57%	6.11%	1.22%	1.77%	3.03%
[1b]	CHX Market Share (% of Total Volume) Index: January 2016 = 100	Aug 2015	75	34	176	78	72
		Sep 2015	106	29	122	80	60
		Oct 2015	71	65	82	102	78
		Nov 2015	78	94	100	118	101
		Dec 2015	85	54	81	103	72
		Jan 2016	100	100	100	100	100
		Feb 2016	83	100	106	102	102

		Mar 2016	49	83	76	82	81
		Apr 2016	40	48	64	62	55
		May 2016	19	39	70	44	46
		Jun 2016	16	57	55	69	60
		Jul 2016	10	67	39	41	55

			Symbol				
			SPY	**DIA**	**IWM**	**QQQ**	**Control Average**
No.	**Calculation**	**Month**	**[1]**	**[2]**	**[3]**	**[4]**	**([2]:[4])**
[2a]	Average Total Volume	Aug 2015	130,150,083	6,153,725	26,846,599	33,963,873	23,568,046
		Sep 2015	94,627,144	6,552,649	21,381,524	28,452,481	19,947,099
		Oct 2015	75,881,581	4,461,519	22,420,310	22,701,556	14,268,977
		Nov 2015	63,307,314	3,673,677	16,624,141	17,531,483	10,308,999
		Dec 2015	87,011,822	4,969,853	23,287,782	24,474,150	16,211,695
		Jan 2016	127,469,871	8,301,912	35,204,822	39,029,308	21,425,674
		Feb 2016	97,911,733	6,121,299	27,668,000	35,547,824	18,060,375
		Mar 2016	63,333,000	2,521,807	20,709,893	17,600,599	9,724,974
		Apr 2016	53,023,531	2,337,084	15,556,074	14,984,599	8,991,216
		May 2016	51,578,634	2,016,095	17,899,288	14,856,962	9,822,504
		Jun 2016	78,385,026	2,740,421	20,938,721	16,963,513	10,240,678
		Jul 2016	49,783,615	2,130,330	14,122,275	11,973,239	5,657,111
[2b]	Average Total	Aug 2015	102	74	76	87	110

	Volume Index: Jan 2016 = 100	Sep 2015	74	79	61	73	93
		Oct 2015	60	54	64	58	67
		Nov 2015	50	44	47	45	48
		Dec 2015	68	60	66	63	76
		Jan 2016	100	100	100	100	100
		Feb 2016	77	74	79	91	84
		Mar 2016	50	30	59	45	45
		Apr 2016	42	28	44	38	42
		May 2016	40	24	51	38	46
		Jun 2016	61	33	59	43	48
		Jul 2016	39	26	40	31	26

			Symbol				
			SPY	**DIA**	**IWM**	**QQQ**	**Control Average**
No.	**Calculation**	**Month**	**[1]**	**[2]**	**[3]**	**[4]**	**([2]:[4])**
[3a]	Time-weighted Average CHX Size At The NBBO	Aug 2015	7,740.13	753.47	2,294.04	3,666.82	2,238.11
		Sep 2015	6,217.48	682.18	2,157.29	4,177.88	2,339.12
		Oct 2015	7,816.38	1,308.53	2,052.68	6,130.87	3,164.03
		Nov 2015	8,983.84	2,439.37	2,158.33	7,182.16	3,926.62
		Dec 2015	5,776.73	1,152.21	1,517.59	4,347.08	2,338.96
		Jan 2016	4,220.05	1,830.97	1,726.35	4,341.83	2,633.05
		Feb 2016	2,642.32	1,829.95	2,004.50	4,523.73	2,786.06
		Mar 2016	1,611.90	2,347.82	2,077.08	5,987.78	3,470.89

		Apr 2016	1,415.95	1,481.35	2,314.10	6,196.84	3,330.76
		May 2016	485.23	1,469.69	2,374.66	7,423.33	3,755.89
		Jun 2016	565.73	1,772.03	2,188.41	7,994.73	3,985.06
		Jul 2016	396.37	3,057.61	2,262.70	8,241.77	4,520.69
[3b]	Time-weighted Average CHX Size At The NBBO Index: Jan 2016 = 100	Aug 2015	183	41	133	84	85
		Sep 2015	147	37	125	96	89
		Oct 2015	185	71	119	141	120
		Nov 2015	213	133	125	165	149
		Dec 2015	137	63	88	100	89
		Jan 2016	100	100	100	100	100
		Feb 2016	63	100	116	104	106
		Mar 2016	38	128	120	138	132
		Apr 2016	34	81	134	143	126
		May 2016	11	80	138	171	143
		Jun 2016	13	97	127	184	151
		Jul 2016	9	167	131	190	172

			Symbol				
			SPY	**DIA**	**IWM**	**QQQ**	**Control Average**
No.	**Calculation**	**Month**	**[1]**	**[2]**	**[3]**	**[4]**	**([2]:[4])**
[4a]	Time-weighted	Aug 2015	19,257.66	2,609.35	6,511.42	18,471.79	9,197.52
		Sep 2015	11,919.38	1,679.93	6,540.46	14,223.92	7,481.44

	Average NMS Size At The NBBO	Oct 2015	18,309.27	2,468.56	6,972.46	19,848.75	9,763.26
		Nov 2015	19,257.58	3,930.75	6,963.92	23,442.48	11,445.72
		Dec 2015	13,230.66	2,204.20	5,812.28	17,106.74	8,374.40
		Jan 2016	9,513.33	2,569.26	5,221.94	14,100.46	7,297.22
		Feb 2016	7,417.60	2,489.46	6,340.40	13,869.32	7,566.40
		Mar 2016	8,638.39	3,703.26	8,521.28	20,316.43	10,846.99
		Apr 2016	9,876.59	3,070.53	9,422.71	23,246.57	11,913.27
		May 2016	9,398.26	3,144.93	10,295.88	28,354.88	13,931.90
		Jun 2016	9,313.10	3,107.54	9,597.43	28,288.57	13,664.51
		Jul 2016	11,685.53	4,711.37	10,026.35	35,353.64	16,697.12
[4b]	Time-weighted Average NMS Size At The NBBO Index: Jan 2016 = 100	Aug 2015	202	102	125	131	126
		Sep 2015	125	65	125	101	103
		Oct 2015	192	96	134	141	134
		Nov 2015	202	153	133	166	157
		Dec 2015	139	86	111	121	115
		Jan 2016	100	100	100	100	100
		Feb 2016	78	97	121	98	104
		Mar 2016	91	144	163	144	149
		Apr 2016	104	120	180	165	163
		May 2016	99	122	197	201	191
		Jun 2016	98	121	184	201	187
		Jul 2016	123	183	192	251	229

			Symbol				
			SPY	**DIA**	**IWM**	**QQQ**	**Control Average**
No.	**Calculation**	**Month**	**[1]**	**[2]**	**[3]**	**[4]**	**([2]:[4])**
[5a]	% of Time CHX Had A Two-Sided Market	Aug 2015	99.8%	99.6%	99.7%	99.6%	99.7%
		Sep 2015	99.9%	99.9%	99.9%	99.9%	99.9%
		Oct 2015	100.0%	99.9%	99.9%	100.0%	99.9%
		Nov 2015	99.9%	99.9%	99.5%	99.8%	99.7%
		Dec 2015	98.6%	98.3%	98.6%	98.6%	98.5%
		Jan 2016	100.0%	99.9%	99.9%	100.0%	99.9%
		Feb 2016	99.9%	100.0%	100.0%	100.0%	100.0%
		Mar 2016	99.8%	100.0%	100.0%	100.0%	100.0%
		Apr 2016	99.3%	99.9%	100.0%	99.8%	99.9%
		May 2016	85.2%	99.9%	100.0%	100.0%	100.0%
		Jun 2016	73.2%	99.9%	100.0%	100.0%	100.0%
		Jul 2016	74.0%	99.9%	100.0%	100.0%	100.0%
[5b]	% of Time CHX Had A One-Sided Market	Aug 2015	0.1%	0.1%	0.0%	0.2%	0.1%
		Sep 2015	0.0%	0.0%	0.0%	0.0%	0.0%
		Oct 2015	0.0%	0.0%	0.0%	0.0%	0.0%
		Nov 2015	0.0%	0.0%	0.0%	0.2%	0.1%
		Dec 2015	0.0%	0.3%	0.0%	0.0%	0.1%
		Jan 2016	0.0%	0.1%	0.0%	0.0%	0.0%
		Feb 2016	0.0%	0.0%	0.0%	0.0%	0.0%

		Mar 2016	0.2%	0.0%	0.0%	0.0%	0.0%
		Apr 2016	0.2%	0.0%	0.0%	0.0%	0.0%
		May 2016	3.0%	0.0%	0.0%	0.0%	0.0%
		Jun 2016	6.1%	0.0%	0.0%	0.0%	0.0%
		Jul 2016	1.8%	0.0%	0.0%	0.0%	0.0%

			Symbol				
			SPY	**DIA**	**IWM**	**QQQ**	**Control Average**
No.	**Calculation**	**Month**	**[1]**	**[2]**	**[3]**	**[4]**	**([2]:[4])**
[5c]	% of Time CHX Had No Market	Aug 2015	0.1%	0.3%	0.3%	0.1%	0.2%
		Sep 2015	0.0%	0.1%	0.1%	0.0%	0.1%
		Oct 2015	0.0%	0.1%	0.1%	0.0%	0.1%
		Nov 2015	0.1%	0.1%	0.4%	0.0%	0.2%
		Dec 2015	1.4%	1.4%	1.4%	1.4%	1.4%
		Jan 2016	0.0%	0.0%	0.0%	0.0%	0.0%
		Feb 2016	0.1%	0.0%	0.0%	0.0%	0.0%
		Mar 2016	0.0%	0.0%	0.0%	0.0%	0.0%
		Apr 2016	0.5%	0.1%	0.0%	0.2%	0.1%
		May 2016	11.8%	0.1%	0.0%	0.0%	0.0%
		Jun 2016	20.7%	0.1%	0.0%	0.0%	0.0%
		Jul 2016	24.2%	0.0%	0.0%	0.0%	0.0%

	Symbol

			SPY	DIA	IWM	QQQ	Control Average
No.	**Calculation**	**Month**	**[1]**	**[2]**	**[3]**	**[4]**	**([2]:[4])**
[6a]	% of Time CHX Was At The NBB	Aug 2015	16.5%	32.7%	46.9%	58.0%	45.9%
		Sep 2015	24.0%	36.4%	44.7%	67.6%	49.6%
		Oct 2015	30.8%	45.8%	44.3%	74.9%	55.0%
		Nov 2015	24.5%	50.3%	54.0%	79.6%	61.3%
		Dec 2015	29.2%	34.1%	38.3%	71.3%	47.9%
		Jan 2016	23.8%	46.0%	40.2%	70.4%	52.2%
		Feb 2016	15.5%	53.9%	33.7%	65.5%	51.0%
		Mar 2016	18.5%	58.4%	35.6%	66.8%	53.6%
		Apr 2016	18.7%	46.8%	35.9%	60.5%	47.7%
		May 2016	7.0%	44.8%	53.5%	68.5%	55.6%
		Jun 2016	5.4%	47.1%	44.2%	72.8%	54.7%
		Jul 2016	8.2%	45.9%	40.8%	74.1%	53.6%
[6b]	% of Time CHX Was At The NBO	Aug 2015	27.9%	39.8%	57.0%	65.6%	54.1%
		Sep 2015	29.7%	36.0%	41.8%	66.7%	48.2%
		Oct 2015	20.9%	41.4%	42.7%	74.0%	52.7%
		Nov 2015	28.7%	39.3%	52.9%	78.2%	56.8%
		Dec 2015	27.1%	35.5%	42.4%	70.0%	49.3%
		Jan 2016	23.3%	52.3%	48.8%	70.4%	57.2%
		Feb 2016	23.2%	55.5%	46.3%	69.1%	57.0%
		Mar 2016	19.0%	58.5%	44.4%	70.0%	57.7%

		Apr 2016	14.0%	44.0%	36.4%	65.8%	48.7%
		May 2016	12.4%	40.4%	49.3%	64.2%	51.3%
		Jun 2016	11.0%	47.3%	48.4%	74.6%	56.8%
		Jul 2016	5.8%	46.0%	34.0%	69.4%	49.8%

			Symbol				
			SPY	**DIA**	**IWM**	**QQQ**	**Control Average**
No.	**Calculation**	**Month**	**[1]**	**[2]**	**[3]**	**[4]**	**([2]:[4])**
[6c]	% of Time CHX Was At The NBB and that CHX Was At The NBO	Aug 2015	1.0%	8.2%	19.7%	32.5%	20.2%
		Sep 2015	2.0%	10.0%	9.2%	37.1%	18.8%
		Oct 2015	3.0%	14.4%	10.2%	49.8%	24.8%
		Nov 2015	6.0%	14.2%	17.9%	58.1%	30.1%
		Dec 2015	4.4%	9.3%	12.5%	44.8%	22.2%
		Jan 2016	3.3%	19.2%	7.8%	41.8%	22.9%
		Feb 2016	1.0%	24.5%	4.8%	35.4%	21.5%
		Mar 2016	0.5%	29.6%	4.6%	38.0%	24.1%
		Apr 2016	0.2%	15.7%	2.2%	29.9%	15.9%
		May 2016	0.0%	13.5%	17.5%	34.6%	21.9%
		Jun 2016	0.0%	17.0%	12.2%	48.5%	25.9%
		Jul 2016	0.0%	12.6%	4.0%	44.1%	20.3%

			Symbol				
			SPY	**DIA**	**IWM**	**QQQ**	**Control Average**
No.	**Calculation**	**Month**	**[1]**	**[2]**	**[3]**	**[4]**	**([2]:[4])**
[7a]	% of Time CHX Was At The NBB And Was The Largest Bid At That Price	Aug 2015	13.6%	26.2%	37.1%	26.6%	29.9%
		Sep 2015	21.5%	34.0%	40.0%	47.6%	40.6%
		Oct 2015	24.9%	43.8%	36.2%	57.4%	45.8%
		Nov 2015	18.8%	47.9%	39.4%	55.9%	47.7%
		Dec 2015	25.1%	31.7%	27.7%	39.1%	32.8%
		Jan 2016	20.0%	43.6%	32.0%	48.1%	41.2%
		Feb 2016	11.2%	52.7%	28.5%	45.5%	42.2%
		Mar 2016	11.9%	55.7%	28.3%	44.8%	42.9%
		Apr 2016	13.0%	42.2%	31.6%	43.6%	39.1%
		May 2016	1.7%	39.8%	37.9%	50.2%	42.6%
		Jun 2016	2.0%	43.7%	32.2%	48.3%	41.4%
		Jul 2016	2.3%	43.2%	31.7%	48.0%	41.0%
[7b]	% of Time CHX Was At The NBO And Was The Largest Offer At That Price	Aug 2015	24.3%	34.4%	51.2%	39.8%	41.8%
		Sep 2015	27.0%	33.8%	37.8%	46.7%	39.4%
		Oct 2015	16.0%	38.1%	31.3%	44.0%	37.8%
		Nov 2015	22.6%	36.8%	35.1%	53.4%	41.8%
		Dec 2015	23.2%	32.7%	30.6%	36.8%	33.4%
		Jan 2016	20.7%	51.1%	41.3%	50.7%	47.7%
		Feb 2016	18.5%	54.7%	40.8%	49.4%	48.3%

		Mar 2016	12.9%	55.2%	35.3%	51.2%	47.2%
		Apr 2016	8.1%	38.6%	30.8%	45.9%	38.4%
		May 2016	3.8%	36.7%	29.8%	45.2%	37.2%
		Jun 2016	4.6%	44.6%	31.4%	51.8%	42.6%
		Jul 2016	1.1%	42.5%	27.0%	31.0%	33.5%

			Symbol				
			SPY	**DIA**	**IWM**	**QQQ**	**Control Average**
No.	**Calculation**	**Month**	**[1]**	**[2]**	**[3]**	**[4]**	**([2]:[4])**
[7c]	% of Time CHX Was At The NBB And Was The Largest Bid At That Price and that CHX Was At The NBO And Was The Largest Offer At That Price	Aug 2015	0.2%	5.3%	12.8%	7.1%	8.4%
		Sep 2015	1.1%	8.5%	7.3%	16.7%	10.9%
		Oct 2015	0.9%	12.3%	5.3%	17.7%	11.8%
		Nov 2015	2.3%	12.6%	7.0%	23.0%	14.2%
		Dec 2015	2.9%	8.1%	6.4%	13.7%	9.4%
		Jan 2016	1.9%	17.3%	4.3%	18.5%	13.4%
		Feb 2016	0.3%	23.3%	2.8%	13.9%	13.3%
		Mar 2016	0.1%	26.0%	2.6%	14.0%	14.2%
		Apr 2016	0.0%	10.9%	1.5%	14.0%	8.8%
		May 2016	0.0%	10.4%	8.0%	15.6%	11.3%
		Jun 2016	0.0%	14.3%	4.8%	18.6%	12.5%
		Jul 2016	0.0%	10.7%	2.8%	10.8%	8.1%

Appendix C: Impact of LTAD on Liquidity Takers

The purpose of this analysis is to show that implementation of LTAD would not materially impact the ability of a random market participant not engaged in a latency arbitrage strategy to take displayed liquidity at CHX. This analysis assumes that LTAD would not materially change order sending behavior of Participants.

For the period of May 2016 through July 2016,[83] the Exchange observed the following with regards to SPY:

- There were a total of 18,316 orders at least partially executed.
- During the same period, the Exchange received 1,278 cancel messages to cancel resting orders after the resting order had been fully executed ("too-late-to-cancel" or "TLTC").
- Of the 1,278 TLTCs, 412 TLTCs (32.24%) were received sooner than or exactly 350 microseconds after the execution ("$TLTC_{\leq 350}$"), whereas 866 (67.76%) were received later than 350 microseconds after the execution ("$TLTC_{> 350}$").
- Of the 412 $TLTC_{\leq 350}$, 392 (95.15%) executions were attributed to SPY latency arbitrage activity while the remaining 20 (4.85%) executions were not.
- Of the 866 $TLTC_{> 350}$, 780 (90.07%) executions were attributed to SPY latency arbitrage activity while the remaining 86 (9.93%) executions were not.[84]

Thus, if LTAD had been in effect for the period of May 2016 through July 2016, LTAD (1) would have prevented up to 412 orders, virtually all of which the Exchange believes were submitted as part of SPY latency arbitrage activity, from being executed during the 350

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83 For the months prior to May 2016 during the Analysis Period, the Exchange did not maintain TLTC data. A limitation of this data is that CHX Market Share and displayed liquidity in SPY and, by extension, order sending activity had all diminished considerably by May 2016. See supra Appendix B Calculation Set 1.

84 See supra note 4.

microsecond Fixed LTAD Period and (2) would have had a negative impact on only 20 liquidity taking orders not attributed to SPY latency arbitrage activity. These 20 orders comprised 0.11% of the 18,316 orders executed during the period. That is, during the measurement period of 63 trading days, LTAD would have had an adverse effect on approximately one order every three trading days. Thus, LTAD can make a significant contribution to leveling the playing field between liquidity providers and latency arbitrageurs with minimal adverse effect on other liquidity taking orders.

2. Statutory Basis

The Exchange believes that the proposed rule change is consistent with Section 6(b) of the Act in general,[85] and furthers the objectives of Section 6(b)(5) in particular,[86] in that it is designed to promote just and equitable principles of trade, to foster cooperation and coordination with persons engaged in facilitating transactions in securities, to remove impediments and perfect the mechanisms of a free and open market, and, in general, to protect investors and the public interest; and is not designed to permit unfair discrimination between customers, issuers, brokers, or dealers.

Specifically, the Exchange believes that the proposed rule change would remove impediments and perfect the mechanisms of a free and open market and, in general, protect investors and the public interest by enhancing displayed liquidity and price discovery for NMS securities by minimizing the effectiveness of latency arbitrage strategies that diminish quality and quantity of liquidity. As shown under the CHX ETF Analysis, latency arbitrage lessens competition among orders by dissuading liquidity providers from displaying large and

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85 15 U.S.C. 78f(b).

86 15 U.S.C. 78f(b)(5).

aggressively priced orders, which in turn impairs market efficiency.[87] The Commission has recognized the crucial role that displayed limit orders play in the price discovery process.[88] Thus, the Exchange believes that optimizing liquidity provision on the Exchange will enhance price discovery for NMS securities and, thereby, enhance market efficiency. To this end, LTAD is designed to promote displayed liquidity on the Exchange by giving liquidity providers a small amount of additional time to cancel or adjust orders on the CHX book to comport to the most recent market data before latency arbitrageurs could take such orders at potentially "stale" prices. LTAD is designed to achieve these goals without adversely affecting the ability of virtually all market participants, other than latency arbitrageurs, to access liquidity at CHX.[89] Thus, the Exchange believes that LTAD will encourage liquidity providers to resume posting large aggressively priced orders on the CHX book, which was their practice prior to the beginning of the SPY latency arbitrage activity in January 2016, which will enhance liquidity and optimize price discovery in furtherance of the objectives of Act and in a manner consistent with Regulation NMS, as described below.

The Exchange also believes that the proposed amendments to the MTP order modifier would remove impediments and perfect the mechanisms of a free and open market and, in general, protect investors and the public interest, in that they are designed to avoid certain

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87 See Exchange Act Release No. 51808 (June 9, 2005), 70 FR 37496 at 37499 (June 29, 2005) ("Regulation NMS Adopting Release"), which provides, in pertinent part: "To the extent that competition among orders is lessened, the quality of price discovery for all sizes of orders can be compromised. Impaired price discovery could cause market prices to deviate from fundamental values, reduce market depth and liquidity, and create excessive short-term volatility that is harmful to long-term investors and listed companies. More broadly, when market prices do not reflect fundamental values, resources will be misallocated within the economy and economic efficiency – as well as market efficiency – will be impaired."

88 See Regulation NMS Adopting Release, id, at 37526.

89 See supra note 19; see also supra Appendix C.

unintended consequences of LTAD on the MTP functionality. Specifically, since an order would be assigned a sequence number prior to being evaluated pursuant to LTAD,[90] LTAD may result in a newer undelayed order being posted to the CHX book before an older delayed order, which would not otherwise occur today. Under this scenario and assuming that the contra-side orders trigger MTP and the incoming order is marked "N," the current MTP rules would require the incoming older order to be cancelled, whereas the amended MTP handling would require the resting newer order to be cancelled subject to the exception for CHX Only orders described under amended Article 1, Rule 2(b)(3)(F)(iii)(a) and (b). Thus, the Exchange believes that the amended MTP functionality better contemplates LTAD and preserves expected results.

Moreover, the Exchange submits that the proposed rules for LTAD are not designed to permit unfair discrimination, and would not impose any unnecessary or inappropriate burden on competition. Rather, by neutralizing speed advantages utilized by latency arbitrageurs, LTAD is designed to ensure that liquidity providers resume achieving their goals with respect to their liquidity provision strategies on CHX that, prior to January 2016, resulted in valuable liquidity in securities such as SPY being provided to the marketplace.[91] [92] In addition, LTAD would facilitate the achievement of such goals while having a de minimis impact on random liquidity takers not engaged in latency arbitrage activities.[93]

In finding that the rules pertaining to the IEX Delay did not permit unfair discrimination, and would not impose any unnecessary or inappropriate burden on competition, the Commission

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90 See supra note 7.

91 See supra note 11; see also supra Appendix A.

92 Since the Entry Event, the Exchange has observed latency arbitrage activity in other S&P-correlated securities traded on CHX, which has also negatively impacted displayed liquidity in those securities.

93 See supra note 19; see also supra Appendix C.

recognized that displayed limit orders or non-pegged non-displayed limit orders, the types of liquidity LTAD is designed to protect, would not benefit from the symmetric IEX Delay[94] because the purpose of such limit orders is to post or execute consistent with their fixed limit price, as opposed to being repriced by an exchange based on changes to the NBBO.[95] When also considering that displayed limit orders and non-pegged non-displayed limit orders -1- are as vulnerable to latency arbitrage attacks as pegged orders[96] and -2- could only be effectively adjusted by the liquidity provider itself in response to market changes if such orders are provided as part of a broader liquidity provision strategy that utilizes proprietary algorithms to price and size such limit orders,[97] it logically flows that the best way to protect such valuable displayed liquidity[98] is through an asymmetric delay, such as LTAD, that empowers liquidity providers to more efficiently execute their liquidity provision strategies that result in valuable displayed liquidity being provided to the market.[99] Thus, given the importance of this displayed liquidity and the ineffectiveness of symmetric delays in protecting limit orders from latency arbitrage, the Exchange believes that LTAD is narrowly-tailored to address latency arbitrage as applied to limit orders and, thus, any discrimination between liquidity providers and liquidity takers is justified and consistent with the requirements of the Act.[100] Further, LTAD will be applied to all

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94 See IEX Approval Order, supra note 16, at 41157.

95 See id.

96 See supra note 3.

97 See supra note 10.

98 See supra Appendix A.

99 See supra notes 11 and 12.

100 The Exchange further notes that discrimination between liquidity providers and liquidity takers, in furtherance of the objectives of the Act, is not without substantial precedence in the NMS. The Commission has previously approved various initiatives that discriminate between liquidity providers and liquidity takers. For example, many national securities

Participants, thus all Participants that provide liquidity in securities subject to LTAD[101] will be able to benefit from the LTAD.

For similar reasons, the Exchange also believes that the proposed rule change is consistent with Regulation NMS as LTAD would constitute a de minimis intentional access delay and is thereby consistent with the requirements of Rule 600(b)(3) of Regulation NMS.[102] Moreover, the Exchange further believes that LTAD is consistent with Rule 611[103] and Rule 610(d) of Regulation NMS.[104]

Specifically, the Exchange believes that the proposed rule change is consistent with the "immedia[cy]" requirement of Rule 600(b)(3) as LTAD is a de minimis intentional access delay and thereby compatible with the Exchange having an "automated quotation" under Rule 600(b)(3) and thus a "protected quotation" under Rule 611.[105] Given that LTAD would enhance liquidity and optimize price discovery in NMS securities, would apply to all Participants and would not unfairly discriminate among Participants as it is narrowly tailored to minimize the effectiveness of latency arbitrage strategies with respect to limit orders, all in furtherance of the

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exchanges, including CHX, utilize the "maker/taker" fee model, which discriminates between liquidity providers and takers for the purpose of incentivizing market participants to provide liquidity to, and/or take liquidity from, the exchange, depending on the exchange's specific implementation. See e.g., Bats BYX Fee Schedule; see also Section E.1 of the CHX Fee Schedule. Similarly, the CHX offers a Market Data Revenue Sharing program, whereby only certain liquidity providers could receive a market data revenue rebate in proportion to the quality of liquidity provided. See Section P.1 of the CHX Fee Schedule. In fact, the IEX Delay discriminates between liquidity providers with resting pegged orders and liquidity takers, thereby necessarily discriminating between liquidity providers that utilize pegged orders and those that do not utilize pegged orders.

101 See supra note 37.

102 See 17 CFR 242.600(b)(3).

103 See 17 CFR 242.611.

104 See 17 CFR 242.610(d).

105 See Final Interpretation, supra note 9, at 40792.

objectives of Section 6(b)(5) of the Act, as discussed above, the Exchange believes that LTAD would not impair fair and efficient access to the Exchange's protected quotation.[106]

Moreover, the Exchange believes that LTAD is consistent with the requirements of Rule 611.[107] As described above,[108] a portion of a Routable Order may be immediately routed away to execute against away protected quotations, with the unrouted remainder being delayed before being permitted to execute against an order resting on the CHX book at a price inferior to the away protected quotations by relying on the proposed Immediate Feedback derived from the immediate routed portion to ignore the away protected quotation. Given that LTAD is de minimis in the context of Rule 600(b)(3), it logically flows that LTAD should also be considered de minimis for the purposes of the "simultaneously routed" Intermarket Sweep Order ("ISO") requirement under Rule 611(b)(6). Thus, the Exchange submits that a delay caused by LTAD between the routing of one or more ISOs to satisfy better priced protected quotation(s) and the delayed execution of a related order through such protected quotation(s) is consistent with the requirements of Rule 611(b)(6).

Similarly, a portion of a Routable Order may be immediately routed away to execute against away protected quotations with the unrouted remainder being delayed before posting to the CHX book at a price that crosses such away protected quotations. This could result if the resting order on the CHX book that resulted in the unrouted remainder being delayed was cancelled before the unrouted remainder were released from LTAD. Under this scenario, given that LTAD is de minimis in the context of Rule 600(b)(3), it logically flows that the de minimis delay caused by LTAD between the routing of one or more ISOs to satisfy away protected

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106 See id.

107 17 CFR 242.611.

108 See supra Example 3.

quotations and the actual display of the related order at a price that crosses such away protected quotations is permissible and consistent with the requirements of Rule 610(d).[109]

B. Self-Regulatory Organization's Statement on Burden on Competition

The Exchange does not believe that the proposed rule change will impose any burden on competition that is not necessary or appropriate in furtherance of the purposes of the Act. To the contrary, the Exchange believes that any burden on competition is necessary and appropriate in furtherance of the purposes of Section 6(b)(5) of the Act because LTAD is functionality that seeks to enhance liquidity and optimize price discovery by deemphasizing speed as a key to trading success in order to further serve the interests of investors and thereby removes impediments and perfects the mechanisms of a free and open market.[110]

The Exchange further notes that market participants will continue to be able to obtain CHX book data via the SIPs or through the Exchange's proprietary book feed, the CHX Book Feed,[111] without delay as the Exchange does not propose to delay any outbound messages or market data. As such, the Exchange submits that any burden on competition, while necessary and appropriate in furtherance of the purposes of that Act, has been minimized.

C. Self-Regulatory Organization's Statement on Comments on the Proposed Rule Change Received from Members, Participants or Others

No written comments were solicited or received with respect to the proposed rule change.

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109 See "Division of Trading and Markets: Responses to Frequency Asked Questions Concerning Rule 611 and Rule 610 of Regulation NMS." U.S. Securities and Exchange Commission, 4 April 2008. Web. 20 June 2016 http://www.sec.gov/divisions/marketreg/nmsfaq610-11.htm ("Question 5.02"); see also CHX Article 20, Rule 6(c)(3).

110 See supra note 15.

111 See CHX Article 4, Rule 1.

III. Date of Effectiveness of the Proposed Rule Change and Timing for Commission Action

Within 45 days of the date of publication of this notice in the Federal Register or within such longer period (i) as the Commission may designate up to 90 days of such date if it finds such longer period to be appropriate and publishes its reasons for so finding or (ii) as to which the self-regulatory organization consents, the Commission will:

A. by order approve or disapprove the proposed rule change, or

B. institute proceedings to determine whether the proposed rule change should be disapproved.

IV. Solicitation of Comments

Interested persons are invited to submit written data, views, and arguments concerning the foregoing, including whether the proposed rule change is consistent with the Act. Comments may be submitted by any of the following methods:

Electronic Comments:

- Use the Commission's Internet comment form (http://www.sec.gov/rules/sro.shtml); or
- Send an e-mail to rule-comments@sec.gov. Please include File Number SR-CHX-2016-16 on the subject line.

Paper Comments:

- Send paper comments in triplicate to Secretary, Securities and Exchange Commission, 100 F Street, NE, Washington, DC 20549-1090.

All submissions should refer to File Number SR-CHX-2016-16. This file number should be included on the subject line if e-mail is used. To help the Commission process and review your comments more efficiently, please use only one method. The Commission will post all comments on the Commission's Internet website (http://www.sec.gov/rules/sro.shtml). Copies

of the submission, all subsequent amendments, all written statements with respect to the proposed rule change that are filed with the Commission, and all written communications relating to the proposed rule change between the Commission and any person, other than those that may be withheld from the public in accordance with the provisions of 5 U.S.C. 552, will be available for website viewing and printing in the Commission's Public Reference Room, 100 F Street, NE, Washington, DC 20549, on official business days between the hours of 10:00 a.m. and 3:00 p.m. Copies of such filing will also be available for inspection and copying at the principal office of the Exchange. All comments received will be posted without change; the Commission does not edit personal identifying information from submissions. You should submit only information that you wish to make available publicly. All submissions should refer to File Number SR-CHX-2016-16 and should be submitted on or before [insert date 21 days from publication in the Federal Register].

For the Commission, by the Division of Trading and Markets, pursuant to delegated authority.[112]

Robert W. Errett
Deputy Secretary

[112] 17 CFR 200.30-3(a)(12).